Nabertherm
MORE THAN HEAT 30-3000 °C

# Operating Instructions Laboratory Furnaces

**Model** **L(T) 3/.. - L(T) 40/.. ; /SKM ; /SW ; HA**
**LV(T) 3 - LV(T) 15**
**LE 2/11 - LE 14/11**
**LA 11/..**

The furnace may only be put into operation when these instructions have been read and completely understood by the operator.

**These operating instructions must be read by every user and must be available at all times.**

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## Designated use

- All laboratory furnaces are designed for commercial use in laboratories.
- Furnaces of the LV-series are especially designed for ashing of laboratory samples.
- A written agreement of Nabertherm is required if the furnace is to be used for other applications.
- The installation instructions and safety regulations must be observed since otherwise the furnace is not regarded as being operated in accordance with the designated use and all claims against Nabertherm become void!

## General description

**Explanation of the model names:**

L .. Laboratory furnace with flap door
LT .. Laboratory furnace with lifting door
LV .. Laboratory ashing furnace with hinged door
LVT .. Laboratory ashing furnace with lifting door
LE .. Laboratory furnace, economy series
L ../3/.. Size
../HA Laboratory furnace with recirculating air blower in the back wall.
../SKM Furnace chamber of ceramic muffle
../SW Weighing furnace with bogie and balance

**Nominal temperatures**

L ../11/.. = 1100 °C
L ../12/.. = 1200 °C
L ../13/.. = 1300 °C

**Equipment**

- All models are equipped with a high-quality, multi-layer and energy-saving heat insulation
- LV .. models have an air-preheating system and an air flow rate per minute which is at least six times the chamber volume at temperatures above 500 °C.
- All models are equipped with a Controller which provides safety against most operating errors. The furnace chamber temperature is measured and regulated by a long-life thermocouple NiCr-Ni (Tmax < 1100 °C) or PtRh-Pt (Tmax > 1100 °C).

**Technical specifications**

| Model | Width* mm | Depth* mm | Height* mm | Weight kg |
|---|---|---|---|---|
| LE 2/11 | 275 | 380 | 330 | 10 |
| LE 4/11 | 350 | 400 | 400 | 18 |
| LE 6/11 | 510 | 400 | 320 | 18 |
| LE 14/11 | 555 | 500 | 370 | 25 |
| L(T)(V) 3/.. | 380 | 370 | 420 | 20 |
| L(T)(V) 5/.. | 440 | 470 | 520 | 35 |
| L(T)(V) 9/.. | 480 | 550 | 570 | 45 |
| L(T)(V) 15/.. | 480 | 650 | 570 | 55 |
| L(T) 24/.. | 560 | 660 | 650 | 75 |
| L(T) 40/.. | 600 | 790 | 650 | 95 |

*Outer dimensions

| Model | Width* mm | Depth* mm | Height* mm | Weight kg |
|---|---|---|---|---|
| L 9/11/SKM | 480 | 550 | 570 | 50 |
| L 9/11/SW | 480 | 550 | 800 | 55 |
| LA 11/.. | 485 | 425 | 565 | 27 |

*Outer dimensions

Furnace ratings: see the type plate on the left-hand furnace side
Dimensions and weights: see table
Protection class: 1
Enclosure rating of the furnace: IP 20

**Thermal safety according to EN 605192-2, 1993:**

- without safety controller: Class 0, in case of error no protection for furnace or material.
- with safety controller: Class 2, in case of error furnace and material are protected

**Ambient conditions**

Temperature: 5 - 40 °C
Humidity: max. 95 %, non-condensing

## Safety

CAUTION! Hot surface
Risk of burns

- Check the furnace for perfect condition before starting operation (with LE-models check especially the radiant heaters). Stop operation of the furnace immediately in case of a failure. **If the furnace is operated in an imperfect condition there is danger to life and limb.**
- The furnace may not be used for heating food and drink for the purpose of consumption.
- When operating the furnace considerable amounts of heat as well as harmful gases and vapours can be released depending on the type of material used. These must be led outside in an appropriate manner. Non-observance can result in a fire risk and danger to health. For more information see “Assembling an exhaust pipe”.
- Operating the furnace with explosive gases or mixtures, or with explosive gases or mixtures created in the process is not permitted. **Caution:** Danger to life! If the furnace is provided with a protective gas connection only non-flammable and non-explosive protective gases are permitted.
- Only use materials whose properties are known.
- In case of unexpected procedures inside the furnace (e.g. strong smoke or odour development) switch the furnace off immediately and wait until it has cooled down by itself. Do not open the door beforehand – there is a risk of fire or explosion.
- The furnace housing/lid and the door handle/handle can get very hot during operation. If the furnace is opened at high temperatures (even when a great distance is kept) there is a risk of burns. Wear suitable protective clothing/safety goggles.
- Do not bring any flammable material close to the furnace **(keep a safety distance of 0.5 m to the sides and 1 m to the top)**.
- Do not place any objects on the furnace as otherwise the carrying-off of heat is impeded, the furnace is damaged and there is a fire hazard.
- Do not insert objects into the openings in the furnace casing, such as exhaust air holes or cooling slots of the switching system. There is a danger of electric shock.
- The models L ../11/.. and L ../12/.. contain ceramic fibre material. In the Federal Republic of Germany actively handling this fibre (e.g. replacing the insulation) is subject to the regulations of the German ordinance concerning

hazardous materials, Annex V No. 7 “Artificial mineral fibres” of June 12, 1998. In the other territories of the European Community ceramic fibres are classified by the Directive 98/69/EC of the Commission of December 5, 1997 as follows: CARC. Cat. 2; R 49; Xi R 38. Working on the fibre insulation must therefore be executed in such a way that the quantity of fibre dusts released is kept at a minimum. We recommend wearing a breathing mask (P2 or higher), protective gloves and a protective suit when working on the insulation or having work done by an expert.

## Installation and commissioning

**Transportation:**

- Wear protective gloves.
- At least two persons (or even more, depending on the furnace size) are required for carrying/transporting the furnace.
- Grip under the furnace sides.
- When using belts these must be placed laterally (crosswise).

**Removing the transport packaging:**

- Remove the transport packaging completely (also inside the furnace).
- Please inform us immediately of any transport damage or incomplete delivery!
- Note for furnace insulations with lightweight refractory bricks: The bricks used may have small holes or blowholes in some parts which are due to the manufacturing process. These holes are normal and a quality characteristic of the lightweight refractory brick.
- Keep the packaging for any service case which might occur.

**Installation site:**

- Place the furnace on a non-flammable support (stone, metal or similar). Keep a safety distance from flammable components of 0.5 m to the furnace sides and 1 m to the top. The minimum distance between the furnace sides and non-flammable materials can be reduced to 0.2m.
- Provide sufficient room ventilation to carry off exhaust heat and gases which develop during the process. Non-observance can result in a fire risk and danger to health.

**Mounting the chimney:**

Depending on the application/order different chimneys are delivered (not included in the scope of supply with a protective gas connection).

**Angled chimney (not for LV-models)**

- A chimney that diverts the gases and fumes escaping from the exhaust air nozzle (back wall) and lets them escape at the top. Cross section: 40 x 30 mm
- Put the chimney on the exhaust air nozzle at the furnace back wall and fasten with the two screws provided.

**Chimney with fan (not for LV-models)**

- Supports ventilation of the gases and fumes from the furnace chamber. Cross section: 85 x 60 mm
- Put the chimney on the exhaust air nozzle at the furnace back wall and fasten with the two screws provided. Plug the connector in the receptacle on the back of the switchgear or in an external receptacle.

**Chimney with fan and catalyst (not for LV-models)**

- Heats up the gases and fumes of the furnace chamber to about 600 °C and feeds them through the catalyst honeycomb. During this process the organic constituents are almost completely burnt catalytically, i.e. are decomposed in carbon dioxide and water vapour. This eliminates most unpleasant smells (e.g. during waste-wax casting).
- Attention! Inorganic substances such as heavy metals, halogen, silicone and fine particulates (even small quantities) can destroy the catalyst!
- It must be ensured that the catalyst is in operation from the program start up to about 600 °C. No statement can be made about the residual substances that are emitted into the environment. They depend to a high degree on the individually employed materials/embedded masses and their composition. Cross section: 120 x 120mm

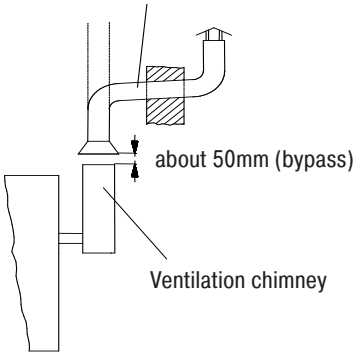
- Fasten the U-shaped holder with the two screws provided to the furnace back wall, put the piece of tube on the exhaust air nozzle of the furnace and screw down the chimney (with catalyst) on the holder. Plug the connector in the receptacle on the back of the switchgear (option) or in an external receptacle.

**With LV-furnaces:**

- These models are delivered with a special exhaust gas tube.
- Fasten the angular tube with the screws provided to the inside housing of the furnace, then fasten the round tube with the screws provided to the outside housing.
- When the furnace is operated without this tube, this will result in a reduced air flow rate which is insufficient for the incineration process.
- Please note: Installation of a catalyst or chimney with fan is not possible with these models.

**Assembling a ventilation pipe:**

Ventilation pipe Ø 80mm assembled at a constant rise




- In any case, we recommend to connect the furnace to an exhaust ductwork and to lead the arising gasses out.
- A standard ventilation pipe of metal with NW80 - NW 120 can be used. It must be laid at a constant rise and fastened to the wall or ceiling.
- Position the pipe in center above the chimney (NW 120 is not required for models with ventilation fan or catalyst).
- Do not mount the ventilation pipe directly to the chimney as otherwise a bypass effect cannot be produced. The bypass effect is required to prevent a too high quantity of fresh air being sucked through the furnace. (Exception LV-furnaces: with these models the ventilation pipe NW80 can be put directly onto the chimney).
- Caution: The exhaust gases can only be carried off if the room is ventilated by a corresponding fresh air opening.

**Mounting the balance (only with the ./SW model):**

- Insert the tube from below into the hole of the furnace floor.
- Place the balance in the frame below the furnace. Lift the tube and set it on the bearing area of the balance. To secure the tube, push the supporting stamp in between tube and bearing area of the balance while lifting the tube.
- Put the ceramic plate with the guide on the tube and align exactly. The tube must be placed freely on the balance and must not touch the furnace insulation so that the measuring result is not affected.
- Connect balance with the mains plug.
- The function of the balance is described in more detail in the separate instructions enclosed.
- Separate instructions for MV-software (option)

**Electrical connection:**

- Plug the mains plug in a corresponding receptacle which is protected sufficiently depending on the rated power of the furnace. If the furnace is ordered/delivered without plug, a qualified electrician must connect the furnace.
- Please note: Using extension cables and/or junction boxes may lead to a reduced furnace output due to the voltage drop in the lines. The power is also reduced if the connection line to the junction box is very long, so that the furnace does not reach its nominal temperature. Please have the connection checked by an electrician. The voltage may not drop below the rated load by more than 10%.

**Entering temperatures and programs**

- Separate instructions for the Controller are enclosed (for the safety regulator as well if the regulator is provided as option).

**First heating up**

- To dry out the brick lining and to create an oxide protection layer on the resistance wire the furnace must initially be heated up. This may cause an unpleasant smell. Provide sufficient ventilation.
- Heat the empty furnace up to 1050 °C in 6 hours (for LE furnaces: heat up to 1000 °C without ramp), maintain this temperature for one hour, then let the furnace cool down by its own.
- The furnace is now ready to operate.

## Operating notes

### General notes

- The insulation consists of high-quality refractory material which is susceptible to shocks. Take care not to knock against the refractory material when charging the furnace to avoid damage.
- In order to achieve an even temperature distribution the furnace should be charged in such a way that the products have a certain distance to each other and also to the side walls. Nabertherm offers shelves etc. so that the furnace chamber can be used in a better way.
- If the furnace is charged with a high quantity of products the heating time may prolong considerably.
- The furnace heating is interrupted when the door is opened and is switched on automatically after the door was closed (not with LE-models).
- The heating program must be interrupted when the furnace is charged to protect the operator and the furnace itself. In case of inobservance there is danger of an electrical shock.
- Do not open the furnace when it is hot. If the furnace must be opened at high temperatures reduce this time to the minimum possible. Wear protective clothing and provide sufficient room ventilation.

- Make sure that the door is correctly closed.
- Discolourations may occur on the stainless steel housing (especially when the hot furnace is opened); these, however, do not affect the function.
- Note for LE-models:
  Permanent temperatures above 1050 °C lead to a higher wear of the heating elements.

### Regulating the fresh air supply

- The volume of fresh air supplied can be set at the fresh air lever. The lever is located on the right-hand side of the door with models with hinged door and with models with lifting door at the bottom of the door. The position is explained by the symbols beside the lever. In position ● the fresh air opening is openend, in position ○ it is closed.
- Note for use of a catalyst or exhaust air blower: Switch the fresh air lever in position ● as otherwise the exhaust gases cannot be removed from the furnace chamber.
- Note for LV-models: These models are equipped with an independent fresh air system which cannot be controlled. The fresh air is led through holes in the back wall in to the upper heating plate where it is preheated and exits to the front above the furnace chamber. When the fresh air lever is in position ● not preheated fresh air is supplied. Switch the lever in position ○ to preheat the fresh air completely.
- Switch the lever in position ○ in case of a protective gas connection/operation.

### Note in case of operation with reduced atmosphere/protective gas

- Reducing atmosphere (deoxidation/exlusion of oxide) has a corrosive effect on the oxide protection layer of the resistance wire. Therefore, the next operation is to be carried out in normal atmosphere with the fresh air lever opened so that the oxide protection layer on the resistance wires can regenerate.

### Note for .../HA models

The air-circulating motor is started when the program is started and is switched off automatically at program end and when the furnace chamber temperature has dropped below 80 °C. **The furnace must not be switched off or disconnected from the mains above this temperature.** Otherwise the air-circulating motor might be damaged.

## Maintenance and fault clearance

Regularly clean the ventilation holes/pipes so that the ventilation cross-section remains unobstructed and the suction functions well.

**In the case of commercial use:**
**Please observe the safety regulations applicable to your country.**

**According to a regulation of the German employer's liability insurance association the furnace must be checked by a qualified electrician at specified intervals.**

Use the error search list (Troubleshooting), the repair instructions and the circuit diagram (see the following pages) to identify and eliminate errors.

**Cracks in the insulation:**
The insulation of the furnace consists of very high-quality refractory material. As a result of heat expansion, cracks appear in the insulation after a few heating cycles. However, these cracks have no influence on the function or quality of the furnace.

## Troubleshooting

| Error | Cause | Error elimination |
|---|---|---|
| Controller does not switch on | No voltage or Controller is defective | • Check/replace the fuse(s) of the connection<br>• Check/replace the fuse of the Controller (if installed)<br>• Check plug connection |
| Controller indicates error | See Controller instructions | |
| No heating of the furnace chamber after the program was started<br>or<br>very slow heating<br>or<br>selected final temperature is not reached | Mistake while entering the program | Check heating program (see Controller instructions) |
| | Door-Safety switch interrupts | Check whether the door or lid is closed: If yes, have switch path of the safety switch checked and if necessary re-adjusted by Nabertherm service. |
| | Fuse/s of the connection is/are defective | Check fuse(s) of the connection, replace if necessary. Inform Nabertherm service if the new fuse blows as soon as it is screwed in. |
| | Heating element is defective | Search for fractures, if no fractures are visible:<br>• Close the cold furnace<br>• Switch on the furnace for about 5 seconds (not longer)<br>• Pull mains plug<br>• Open the door<br>By carefully touching the heating elements check the heat at various positions<br>cold heating elements = heating circuit defective, for repair please see repair instructions |
| | No heating power as a result of undervoltage | Have checked by Nabertherm service. |

## Repair instructions

**Only a qualified electrician may carry out work on the electrical system! This also applies to repair work which is described hereafter.**

## Ordering spare parts

In writing, by phone or via the Internet:
www.nabertherm.com
State the following information from the type plate:

- Furnace model
- Production or serial number
- Year of construction

Only use original spare parts from Nabertherm as otherwise all guarantee becomes void.

## Safety instructions (not for L . ./13)

This furnace contains ceramic fibre material in the insulation. In the Federal Republic of Germany actively handling this fibre (e.g. replacing the insulation) is subject to the regulations of the German ordinance concerning hazardous materials, Annex V No. 7 “Artificial mineral fibres” of June 12, 1998. In the other territories of the European Community ceramic fibres are classified by the Directive 98/69/EC of the Commission of December 5, 1997 as follows: CARC. Cat. 2; R 49; Xi R 38. Working on the fibre insulation must therefore be executed in such a way that the quantity of fibre dusts released is kept at a minimum.
We recommend to wear a breathing mask (P2 or higher), protective gloves and a protective suit or having work done by an expert.

## Replacing the heating plates or heating coil (except LE-models)

**Removal**

- Pull mains plug
- Remove back wall cover
- Loosen and remove terminals at the ends of the heating coil
- Pull off wall ducts (at L 3/.. pull of silicone hoses first)
- Pull out any fixing clamps from the lining (furnace chamber).
- Take side ceramic support pipes (L 5/.. - L 15/..) out of the chamber
- Remove the heating plates or the heating coil

**Insertion**

- Clean furnace chamber and wall ducts from residues.
- If cleaning the wall ducts is not possible, insert new pipes.
- Insert new heating plates or heating coil, push connection ends through the holes.
- Put new fixing clamps* in the brick lining (do not use the old holes).
- Place a small amount of fibre wool* around the connection ends from the outside and insert wall ducts.
- Make the electrical connections with new terminals*:
  Hold terminal bottom with tongs, tighten the screw.
- Cut off any excess twisted wire ends. If a line must be connected using a cable lug:
  Place cable lug onto the thread of the tightened screw and secure with hexagon nut. Hold screw so that it cannot come loose.
- Assemble back wall cover

**are included in the spare parts delivery*

## Replacing the radiant heater (LE-models)

- Switch off the furnace and pull the mains plug
- Remove door by loosening the two fastening screws on the bottom right- and left-hand side.
- Place the furnace on its front side (use a soft support)
- Remove back wall cover
- Loosen terminals on the heating coils and the thermocouple
- Pull off ducts from the resistance wires
- Remove internal back wall cover
- Take out rear heat insulation boards carefully
- Pull fibre wool out of the connecting groove between upper and lower location hole on the back side of the collar.
- Remove radiant heaters and insert new ones.
- Make sure that the wire is deeply inserted in the connecting groove and carefully stuff with fibre wool*.
- Reinsert heat insulation boards carefully
- Install internal back wall, press tightly and tighten screws.
- Insert wall ducts
- Make the electrical connections on the heating elements with new terminals*. Hold terminal bottom with tongs.
- Cut off any excess wire ends.
- Connect thermocouple lines (observe correct polarity!)
- Assemble back wall cover
- Place furnace on its feet
- Mount door

** are included in the spare parts deliveryi*

## Repairing the lining (only furnace with brick insulation)

**The following note applies to a furnace insulation with lightweight refractory bricks:**
The lightweight refractory bricks of your furnace are of very high quality. Due to the manufacturing process small holes or blowholes may occur in some parts. These, however, are to be regarded as normal and underline the quality characteristics of the brick.

If the insulation of the furnace chamber shows serious damage, it must be repaired.

- Pull mains plug
- Remove any remaining dust with vacuum cleaner
- Fill damaged areas with repair kit (Nabertherm service)
- Repair kit must dry for 24 hours before the furnace is commissioned

## Replacing the thermocouple

- Pull mains plug
- Remove protective cover of the electric terminals on the back of the furnace
- Loosen the safety screw of the thermocouple
- Loosen the cable ends on the thermocouple
- Remove defective thermocouple, insert new one
- Connect new thermocouple (observe correct polarity!)
- Attach the thermocouple by means of safety screw to the furnace housing
- Assemble back wall cover

### Replacing the fan motor/fan wheel (only with . ./HA models)

- Switch off the furnace and pull the mains plug
- Detach back wall cover and remove back wall cover.
- Dismount fibre cover plate of the fan wheel in the furnace chamber. To do so, pull out the four clamps in the rear corners and remove plate carefully to the front.
- Loosen setscrew on the shaft between furnace back wall and fan motor.
- Fasten fan motor and pull out fan wheel with a rotating movement from the furnace chamber side.
- Pull off cable on the fan motor, loosen the three fastening screws and remove motor.
- Assemble in reverse order.

## Disposal

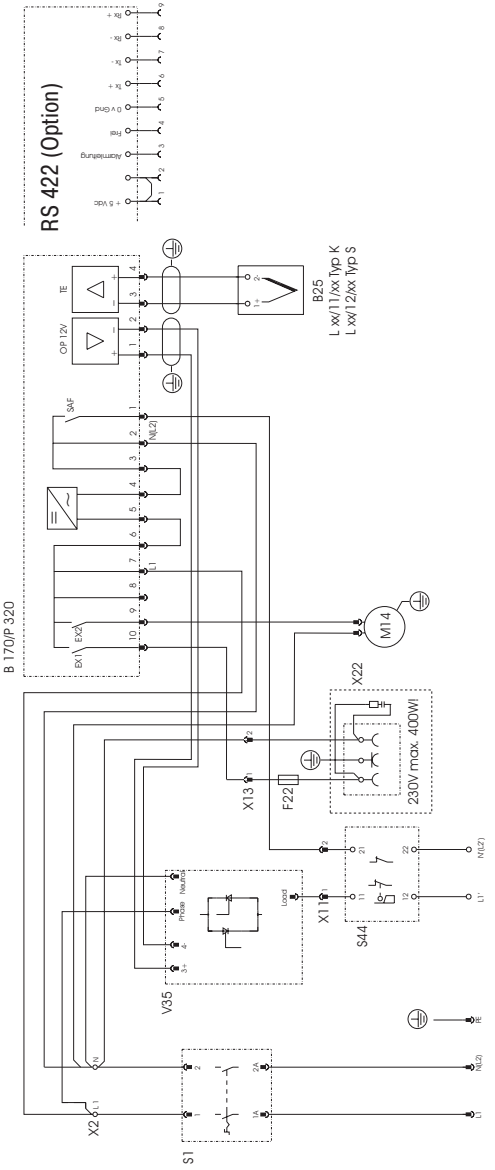
Upon delivery the furnace does not contain any material which is to be classified as hazardous waste. However, process residues may collect in the insulation during operation. These may be dangerous to health and/or dangerous to the environment.

Therefore, we recommend to proceed as follows:

- Remove electrical components and dispose of as electrical waste.
- Remove insulation and dispose of as special/ hazardous waste (wear a protective mask P2, protective gloves and a protective suit).
- Dispose of the housing as scrap metal

## Circuit diagrams

L(T)(V)3 - 15/../B170 or P320 /(SW)/(SKM)(HA) and LA with B170 or P320
110-120V, 200-240V ~ 1P/NPE, 2P/PE, 50/60Hz

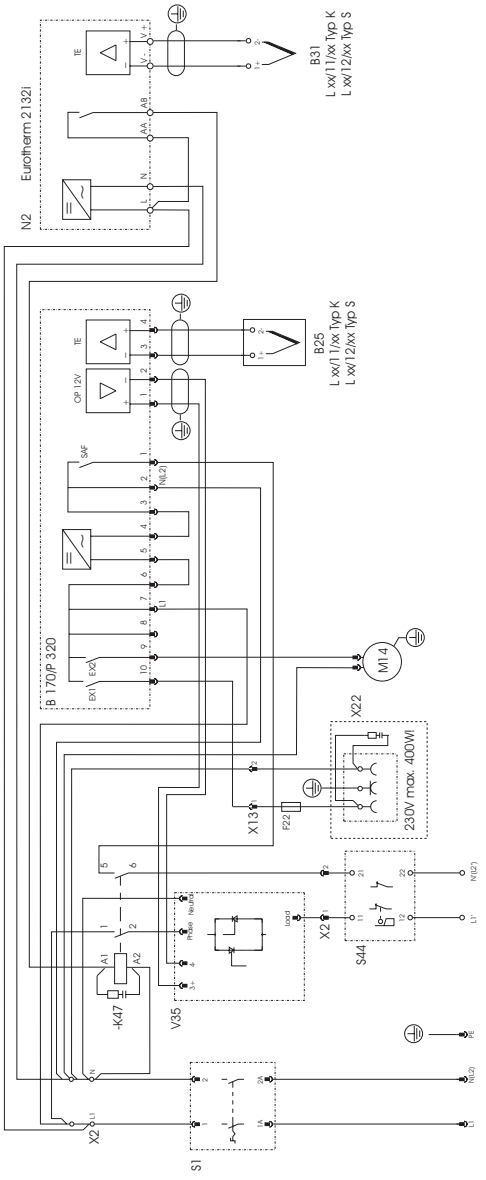



B25 Thermocouple
F22 Fuse of receptacle (5x20, 250V/M2A)
M14 Recirculating air fan (only /HA)
S1 Mains switch
S44 Door contact switch
V35 Semiconductor relay
X22 Socket (not all models)

See „Wiring of the heating elements“

Power supply see ratings sign

L(T)(V)3 - 15/../B170 or P320 /(SW)/(SKM)(HA) and LA with B170 or P320
with safety regulator 2132i
110-120V, 200-240V ~ 1P/NPE, 2P/PE, 50/60Hz

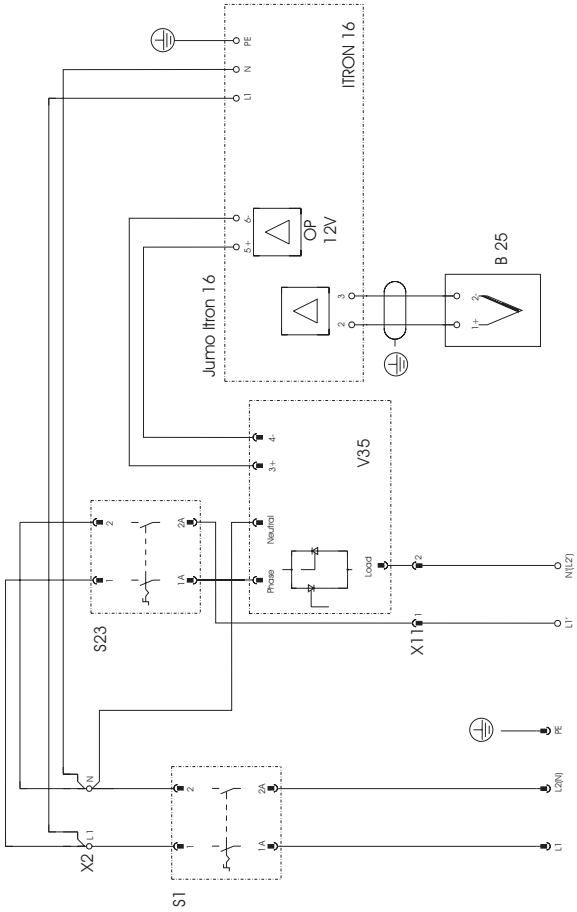



B25 Thermocouple, furnace
B31 Thermocouple, safety regulator
F22 Fuse of receptacle (5x20, 250V/M2A)
N2 Temperature selection limiter
M14 Recirculating air fan (only /HA)
S1 Mains switch
S44 Door contact switch
V35 Semiconductor relay
X22 Socket (not all models)

Power supply see ratings sign

See „Wiring of the heating elements“

LE 2-4/.. Controller ITRON 16
110-120V, 200-240V ~ 1P/N/PE + 2P/PE, 50/60Hz

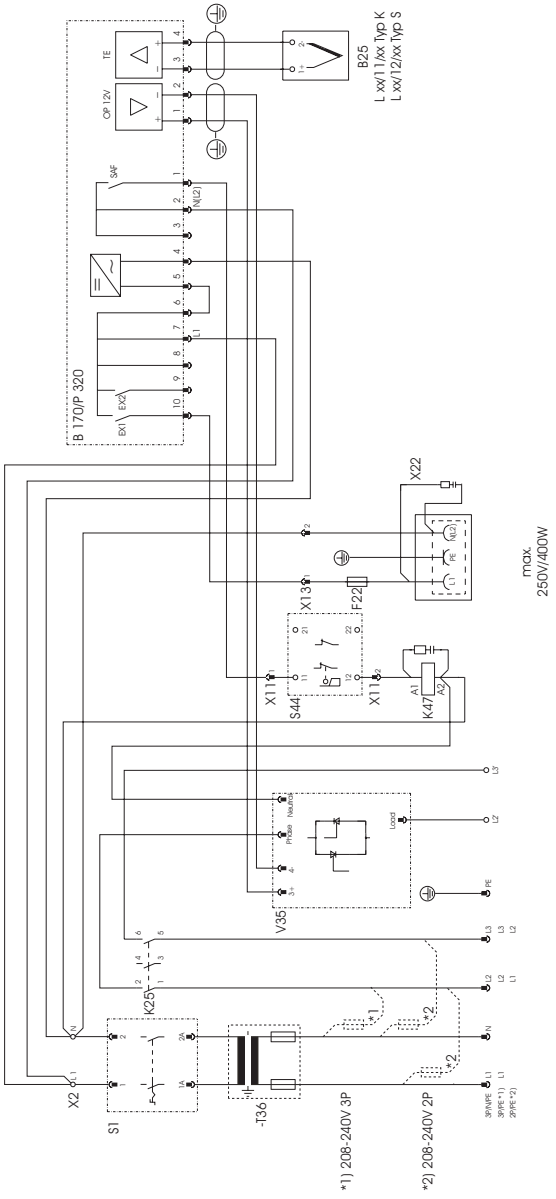



B25 Thermocouple
S1 Mains switch
S23 Switch "Heater ON"
V35 Semiconductor relay

See „Wiring of the heating elements"

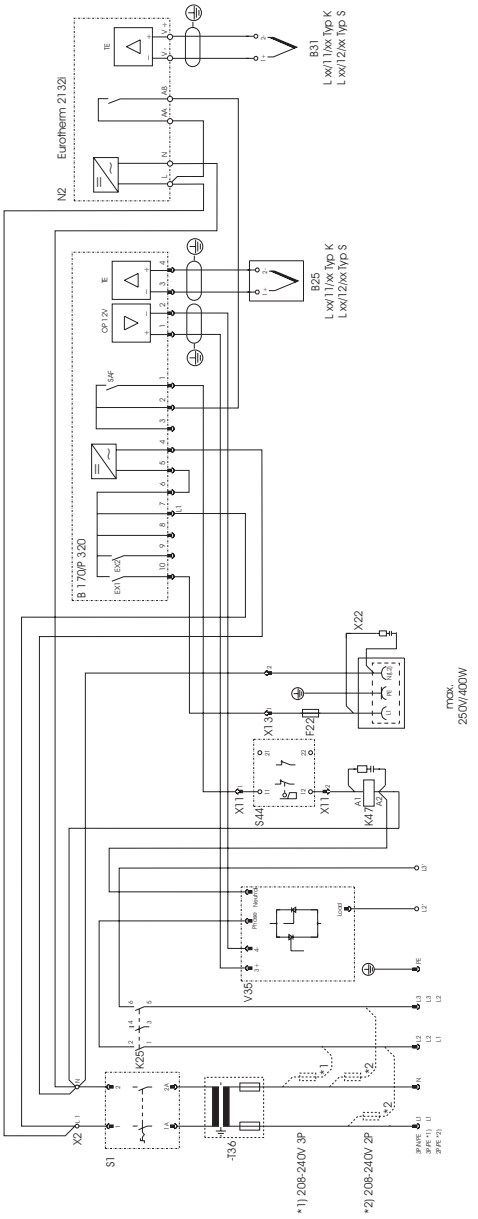
Power supply see ratings sign

L 24 - 40/11/12/ with B170/P320
200-400V ~ 3P/NPE, 3P/PE, 2P/PE 50/60Hz




B25 Thermocouple, furnace
B31 Thermocouple, safety regulator
F22 Fuse of receptacle (5x20, 250V/M2A)
K47 Safety contactor
S1 Mains switch
S44 Door contact switch
T36 Control transformer (not all models)
V35 Semiconductor relay
X22 Socket (not all models)

# L 24 - 40/11/12/ with B170/P320 with safety regulator 2132i
# 200-400V ~ 3P/NPE, 3P/PE, 2P/PE 50/60Hz




Power supply see ratings sign

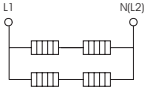
See „Wiring of the heating elements“

B25 Thermocouple, furnace
B31 Thermocouple, safety regulator
F22 Fuse of receptacle (5x20, 250V/M2A)
K47 Safety contactor
N2 Safety regulator
S1 Mains switch
S44 Door contact switch
T36 Control transformer (not all models)
V35 Semiconductor relay
X22 Socket (not all models)

## Wiring of the heating elements

# 1P/N + 2P, 110-120V

L(E)(V)(T)3-15/xx/xx

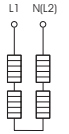



LA 11/xx/xx

# 1/N + 2P, 200-240V

L(E)(V)(T)3-15/xx/xx

L(T) 24/xx/xx
L(T) 40/xx/xx




LA 11/xx/xx

# 2P + 3P, 380-400V

L(T) 24/xx/xx
L(T) 40/xx/xx

## Declaration of Conformity

for furnaces with Nabertherm switchgear including Controller

### EC – DECLARATION OF CONFORMITY

according to EC Low-Voltage Directive No. 73/23/EC modified through 93/68/EC
and EMC Directive 89/336/EC

Nabertherm GmbH,
Bahnhofstr. 20, 28865 Lilienthal

**electrically heated chamber furnaces**

**Models:**

L(T) 3/.. – L(T) 40/.. ; /SKM ; /SW ; HA

LV(T) 3 – LV(T) 15

LE 2.. – LE 14..

LA 11/..

For all Furnaces: With switchgear 110-480V and Nominal frequency of 50/60 Hz

| | | |
|---|---|---|
| **Harmonized standards/valid EC Directives** | | EN 746-1 |
| **Low-Voltage Directive:** | EN 60335 | EN 61010-1 |
| **EMC-Directive:** | EN 61000-6-1 | EN 61000-6-3 |

Lilienthal, 11.10.2005

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Headquarters: No responsibility is accepted for the correctness of this information, we reserve the right to make technical alterations

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# Operating Instructions

## Controller

## B130/B150/B180/C280/C290/C295/P330

-> 06.2008

englisch

Nabertherm

MORE THAN HEAT 30-3000 °C

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# 1 Introduction

**Dear Customer,**

Thank you for choosing a quality product from Nabertherm GmbH.

With this system, you have selected a product which is tailored specifically to your manufacturing and production conditions and of which you can be justifiably proud.

This product is characterized by

- Easy operation
- LCD display
- Rugged construction
- For use near machinery
- Optional RS-422 data interface

Your Nabertherm Team

**Note**

These documents are only intended for the purchasers of our products and must not be duplicated or imparted to or made accessible to third parties without written approval.

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**Industrial property rights**

All rights to drawings and other documents plus all rights of disposal are held by Nabertherm GmbH, including in the event of industrial property right applications.

## 1.1 Warranty and Liability

§

**The Nabertherm warranty conditions or warranty services regulated in the individual contracts apply with regard to the warranty and liability. However, the following also additionally applies:**

Warranty and liability claims in the event of personal injury and material damage are out of the question if these are attributable to one or more of the following causes:

- Each person involved in operating, installing, maintaining or repairing the system must have read and understood the operating instructions. No liability is accepted for damage and malfunctions arising from nonadherence to the operating instructions.
- Improper use of the system.
- Improper installation, commissioning, operation and maintenance of the system.
- Operation of the system with defective safety systems or improperly installed or nonfunctional safety and protective devices.
- Nonadherence to the notes contained in the operating instructions regarding the transport, storage, installation, commissioning, operation, maintenance and setup of the system.
- Unauthorized system design changes.
- Unauthorized operating parameter changes.
- Unauthorized parameterization, setting and program changes.
- Original parts and accessories have been designed especially for Nabertherm furnace systems. Only use original Nabertherm replacement parts. Otherwise, the warranty will be void. Nabertherm assumes no liability for damages resulting from use of nonoriginal parts.
- Catastrophes due to the effects of foreign bodies and force majeure.

## 1.2 General

Before working on electrical systems, switch the power switch to "0" and disconnect the power cord!

Even with the power switch off, some parts in the furnace may carry voltage!

Work on the electrical system may only be done by a trained person!

The furnace and switching system have been preset by the Nabertherm company. If required, a process-dependent optimization must be carried out in order to achieve the best possible control behavior.

The temperature curve must be modified by the user so that the load, furnace or surrounding are not damaged. Nabertherm GmbH assumes no guarantee for the process.

**Note**

Before working on the program-controlled grounding receptacle (optional series L, HTC, N, HL) or the device connected to it, always turn off the furnace and disconnect the power cord.

Carefully read the operating manual of the controller in order to avoid operation mistakes or malfunction of the controller/furnace during operation.

## 1.3 Safety

The controller has a series of electronic safety systems. If a fault occurs, the furnace automatically shuts off and a fault message appears in the LCD display.

**Note**

For more information, please see Chapter "Faults - fault messages"

**Warning! General Hazards!**

The Operating Instructions must be followed prior to switching on the furnace.

# 2 Operation

## 2.1 Power Switch/Control Current Switch

The power switch/control current switch is located below or next to the keyboard block. Stop running heating programs before turning off the furnace with the power switch.

## 2.2 Turning on the Controller/Furnace

Switch power switch to "**I**" position. The controller first displays the controller type and version number and then the temperature display. If the temperature is displayed, the controller is ready to operate.

**Turning on the controller**

Display | Version number | Temperature display

All necessary settings for proper function have already been done at the factory.

For the B 130 and C 280, heating programs for baking and glazing (see chapter "Preconfigured programs for the B 130/C 280") are configured. For the other controllers, the heating programs must be configured on a process- or user-specific basis.

**Note**

Some new functions depend on the version number. Turn the controller off and on again briefly to be able to read the version number.

## 2.3 Turning off the Controller/Furnace

Turn off main switch at position "**O**".

**Note**

Stop running heating programs before turning the furnace off at the main switch, since the controller will otherwise generate a fault message when it is turned back on.
See Faults/fault messages

# 3 Control Fields and Display

## P 330

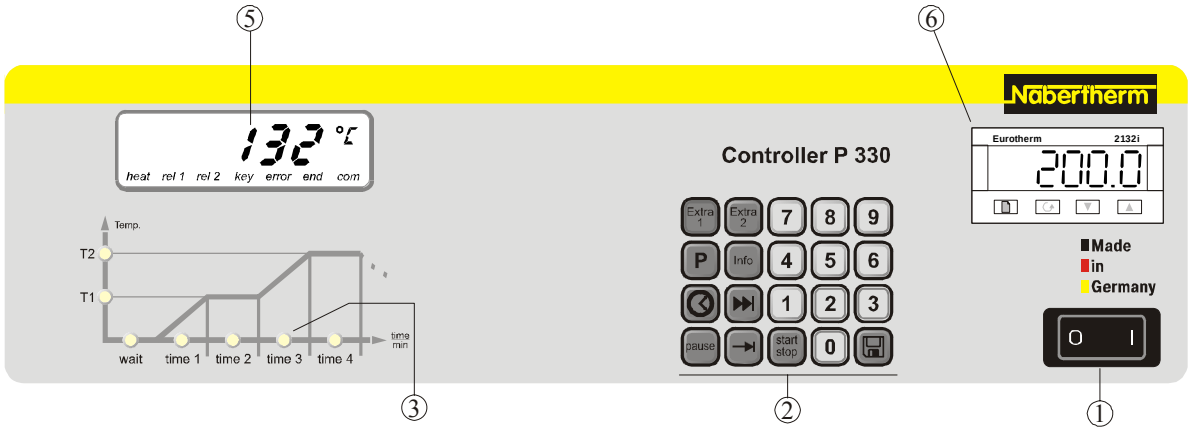



Fig. 1: P 330 control field

## B 180

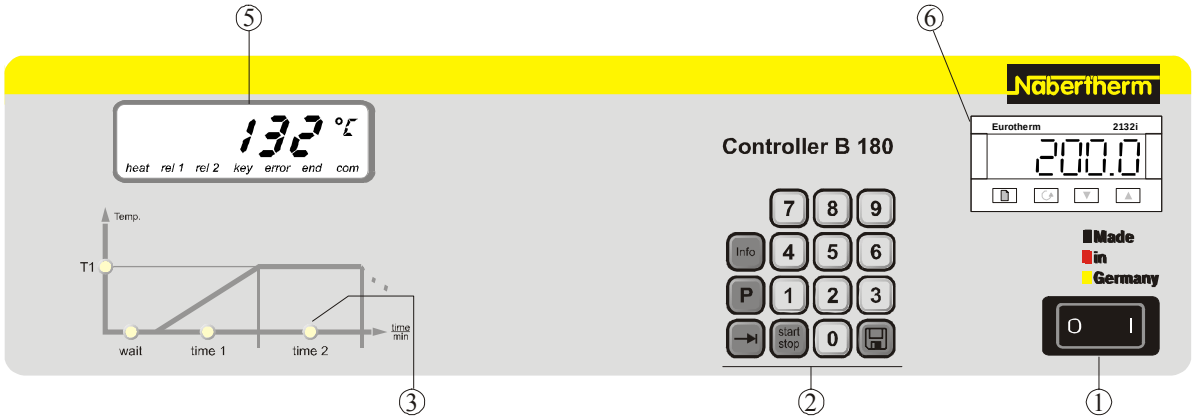
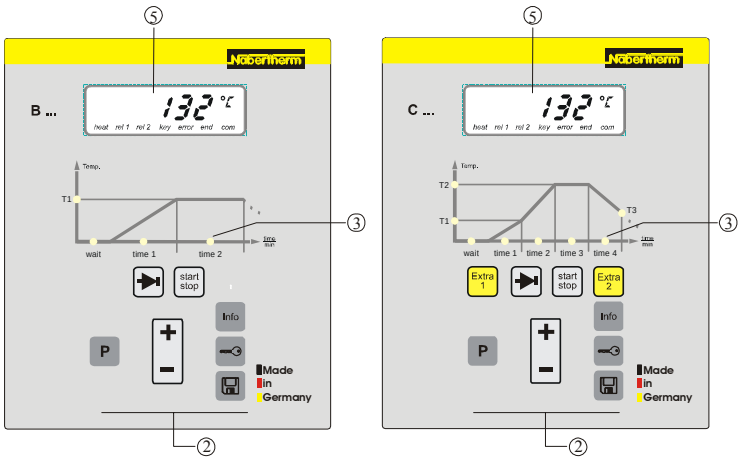



Fig. 2: B 180 control field

## B130/B150/C280/C290/C295




1 = Power switch

2 = Keyboard block

3 = Program LED

4 = Programming keys

5 = Display

6 = Over-temperature limit controller (optional)

Fig. 3: B130/B150/C280/C290/C295 control field

## 3.1 Displays

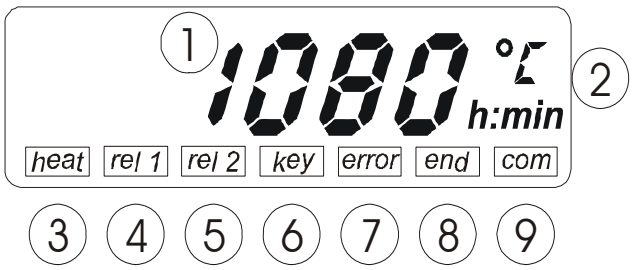



Fig. 4: Display

1 = Furnace temperature
2 = Temperature unit °C/°F
3 = Heating on
4 = Extra relay 1 ON
5 = Extra relay 2 ON (or ventilation motor ON
6 = Key lock (B 130/C 280 only)
7 = Error message
8 = Program end
9 = PC communication (optional)

## 3.2 Keyboard Blocks

### B150, C 290 and C295

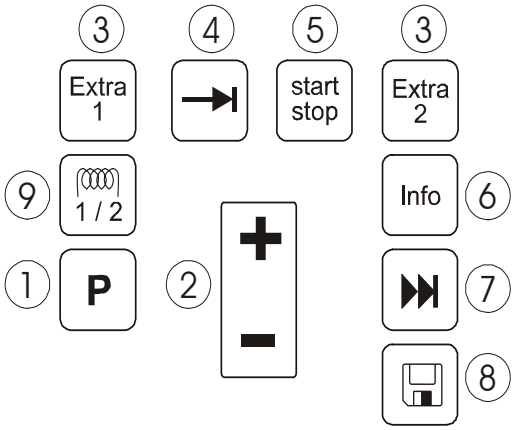



Fig. 5: B 150, C 290/C 295 keyboard block

1 = Program selection
2 = +/-
3 = Extra functions (not B 150)
4 = Page
5 = Program start/stop
6 = Info menu
7 = Segment skip (not B 150)
8 = Save
9 = Heating circuit (C 295 only)

### B 130 and C 280

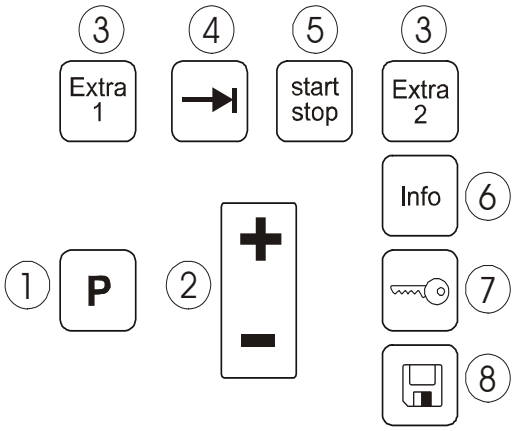



Fig. 6: B 130/C 280 keyboard block

1 = Program selection
2 = +/-
3 = Extra functions (not B 130)
4 = Page
5 = Program start/stop
6 = Info menu
7 = Key lock
8 = Save

**P 330**

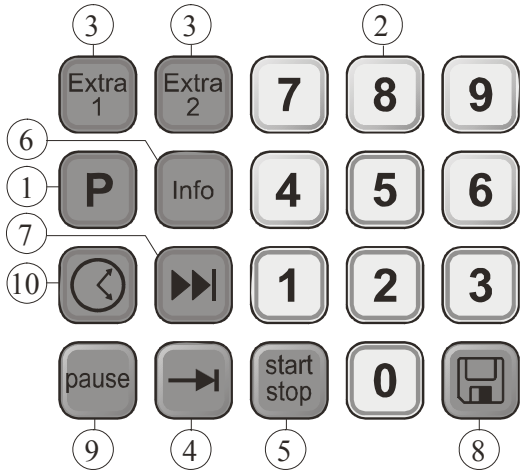



Fig. 7: P 330 keyboard block

**B 180**

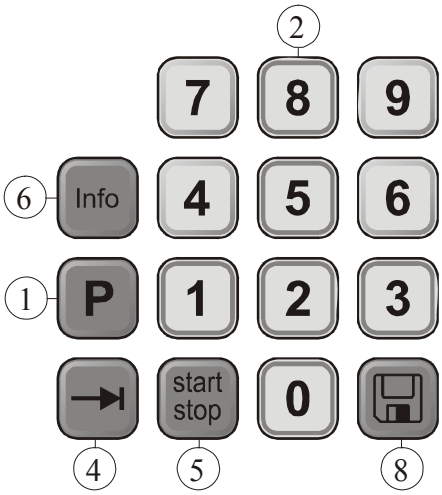



Fig. 8: B 180 keyboard block

1 = Program selection
2 = Numerical block
3 = Extra functions
4 = Page
5 = Program start/stop
6 = Info menu
7 = Segment skip
8 = Save
9 = Pause
10 = Time

# 4 Features of the Controller

## 4.1 Functions

| Controller / Function | B 130 | B 150 | B180 | C 280 | C 290 | C 295 | P 330 |
|---|---|---|---|---|---|---|---|
| **Over-temperature protection** [1)] | √ | √ | √ | √ | √ | √ | √ |
| **Extra relay function** | - | - | - | 2 | 2 [4)] | 2 [4)] | 2 [4)] |
| **Manual configuration of the heating circuits** | - | - | - | - | - | √ | - |
| **Ventilation motor control** [2)] | | √ | √ | √ | √ | √ | √ |
| **Waiting time** | √ | √ | √ | √ | √ | √ | √ |
| **Number of programs** | 2 | 1 | 1 | 9 | 9 | 9 | 9 |
| **Number of segments** | 4 | 2 | 2 | 4 | 40 | 40 | 40 |
| **Auto tune** | √ | √ | √ | √ | √ | √ | √ |
| **kW/hr counter** [3)] | √ | √ | √ | √ | √ | √ | √ |
| **Operating hours counter** | √ | √ | √ | √ | √ | √ | √ |
| **Real-time clock** | - | - | - | - | - | - | √ |
| **Acoustic signal** | - | - | - | - | - | - | √ |
| **RS-422 data interface** | Optional | Optional | Optional | Optional | Optional | Optional | Optional |
| **Constant heat output** | - | - | - | - | - | √ | Optional |

**1)** When the program starts, the highest temperature in the program is calculated. If the furnace is 30°C warmer than the highest program temperature for 3 minutes during the program sequence, the controller turns off the heating and the safety relay, and a fault message appears.

**2)** Preconfigured function for circulation furnaces: Once a program has been started on the controller, the air circulation motor starts. It remains in operation until the program terminates or is interrupted, and the furnace temperature falls back below 80°C. Extra function 2 is no longer available with this function.

**3)** The kW/hr counter calculates the power theoretically consumed over the time the heater is turned on for a heating program at nominal voltage. However, there may actually be deviations: If the voltage is low, the power consumption displayed will be too high, and for a higher voltage the power consumption displayed will be too low.

**4)** In furnaces with an air circulation motor, only one extra function is usually available (see furnace operating instructions).

# 5 New Functions of the Nabertherm Controller

## 5.1 Program Entry with/without Gradient as of Version 3.xx

As of controller version 3.xx you can enter ramps either as gradients (e.g. 120°C/h) or using the "time and target temperature" combination.

Turn the controller off and on again briefly to be able to read the version number.

The input mode can be changed on a user-specific basis in the configuration in support of the process specification. To change the input mode, see "Configuration"

The mode configured can be seen during program input in a segment, e.g. "**time 1"**, as follows:

For "time and set temperature" input, only °C/°F **or** the time **h** is displayed as the input unit. For gradient input, °C/°F **and h** appear together in the display as the unit. The maximum gradient is 6000°C (fast heating)

**Note**

The unit of time for the gradient input is preset to **hours** (h) and cannot be changed to minutes.
Example: 100°C/**h**

## 5.2 Program Starting Behavior for warm Furnaces as of Controller Version 3.xx

If the furnace temperature ① at program start is higher than the set temperature ② of the **first** segment **"T 1",** the program start is delayed until the furnace chamber temperature cools to a value of T1 + 10 °C ③. That is, segment "**Time 1"** is skipped and the program start occurs in the following segment "**Time 2".**

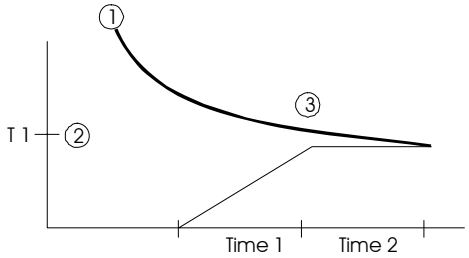



Fig. 9: Program start behavior

This **program start behavior** is permanently programmed into all controllers as of version number 3.xx and cannot be changed. Turn the controller off and on again briefly to be able to read the version number.

## 5.3 Power Failure Behavior

As of controller version 3.xx the power failure behavior can be configured.
Turn the controller off and on again briefly to be able to read the version number. To change the power failure behavior, see chapter "**Configuration/customer-specific settings"**.

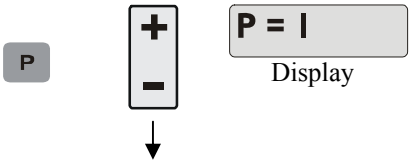
# 6 Controller B 130/C 280

## 6.1 Brief Instructions

**Turning on the controller**

Display — Version number — Temperature display

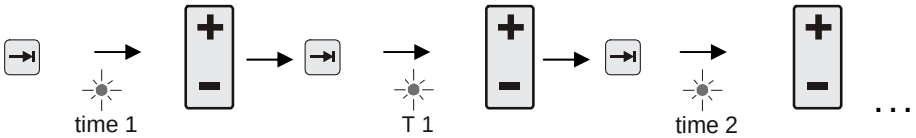
**Call program**




Display

Confirm program selection with

**Enter / control program**




Enter time segment 1 — Enter temperature 1 — Enter time segment 2

**Start program**

Display

## 6.2 Setting or changing Program/Waiting Time

For the automatic operation of the furnace, before starting the controller a temperature characteristic must be configured which describes the desired temperature behavior. This configured temperature behavior is also called a heating program.

Each heating program for the B 130 and C 280 has two ramps, one holding time, and one cooling ramp.

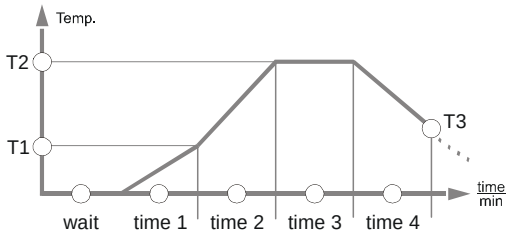


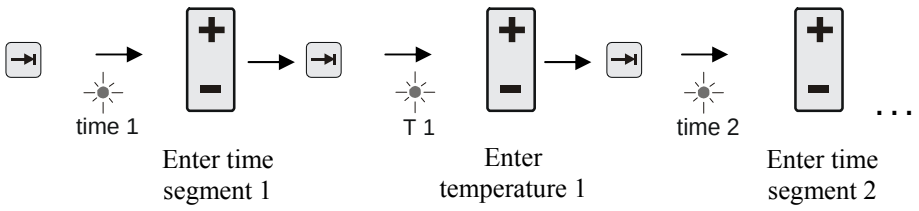

Fig. 10: Program graphic, B 130/C 280

- In the **ramps**, a segment temperature "**T**" and a segment time, "**time 1**" and "**time 2**" define a linear temperature increase (slow heating).
- In the **holding time,** "**time 3**"determines how long the temperature value configured in "**T 2**" should be held.
- In the **cooling time**, the natural cooling can be slowed using the rate set in "**T 3**" and "**time 4**". If there is no specification in "**T 3**" and "**time 4**", the program is already terminated after "**time 3**" has elapsed.

**Program Entry**

Using the paging key ⇥ you can enter input mode. Every push selects the following segment or time value. The selected value is displayed with the blinking LED for either "**T**" or "**time**".

**Enter / control program**




In the display, the temperature value "**T**" or time value "**time**" corresponding to the flashing LED is shown.

If the value displayed should not be changed, use the page key ⇥ to page to the next temperature or time value.

The display also shows the unit of the value expected:

- set temperature values with **°C/°F**

- set time specifications with **hr:min**

- set gradient specifications with **°C/hr:min** or **°F/hr:min**

If a value should be changed, you can set it with the key.

Each time you press the key, the value changes by 1 °C or by one minute.

If you hold the key down, the value first changes in steps of 10,

and if you hold the key down for a longer time, the value changes in steps of 100.

Entry of times is done in hours and minutes, e.g.**6 hr** and **30** min as **06:30**.

For holding times, an entry of **99:59** means program execution will continue forever. When input is complete, the program can be started (see Starting the program).

If ramps contain the time entry **00:00**, the controller attempts to reach the temperature value stored in "T" as quickly as possible

If no key is pressed for 60 seconds, the display automatically returns to the display of temperature. Changed settings are initially only buffered. If a changed or new program should be permanently stored in the controller for more frequent use, see "Saving programs".

**Note**

Not all segments have to be programmed. For segments which are not needed, the temperature and time values must be set to "**0**". The controller then automatically ends the program after the last segment programmed

## 6.3 Setting or changing the Waiting Time

**Waiting time B 150/C 290/C 295/B 180**

To start a heating program automatically at a later point in time, e.g. after a drying time, a waiting time "**wait**" can be programmed.

To select the waiting time, press the **key** repeatedly until the

LED flashes.

The entry of times is in hours and minutes, e.g. 6 hrs and 30 min as 06:30, i.e., when a heating program is started, first the wait time elapses and only then does the program start with segment 1 and heating.

## 6.4 Programming Extra Functions

With controllers of types "**C**" and "**P**", up to two optional extra functions "**Extra 1**" and "**Extra 2**" can be turned on or off in the segments depending on the program

Extra functions are, for instance, exhaust air flaps, fans, solenoids, or optical and acoustic signals, which have been included in the furnace (if applicable, see additional operating instructions for extra functions)

These extra functions can be specified during program entry in all segments, e.g. "**time 1**", by selecting the "**Extra 1**" or "**Extra 2**" key.

That is, when the controller processes the programmed segment, the extra functions are automatically turned on and then turned back of in the next segment, for instance.

Programming of extra functions is done during program entry.

The desired segment must be selected as described in "Entering programs/wait time", so that the corresponding LED, e.g. "**time 1**", is flashing.

If the "**Extra 1**" or "**Extra 2**" key is now pressed, the extra function is specified for this segment, and in the display the status field "**REL 1**" lights up for "**Extra 1**" and/or "**REL 2**" for "**Extra 2**". During program execution, the programmed extra function is automatically turned on during this segment.

To turn off the specification of an extra function, press the corresponding "**Extra**" key again – in the display, the status field "**REL 1**" or "**REL 2**" disappears – the extra function is now no longer turned on. Both extra functions can also be activated at the same time.

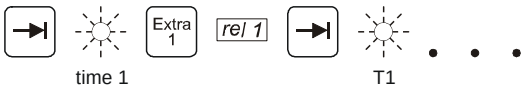



Fig. 11: Selection of "**Extra 1 funktion**" in segment "**time 1**"; LED "**time 1**" flashes

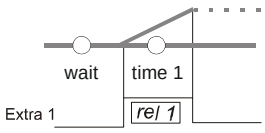



Fig. 12: In the display, "**REL 1**" lights up for the selected "**Extra 1 funktion**"

When paging through the program with →|, programmed extra functions are indicated in each segment ("**time**" LED flashing) with the status fields "**REL 1**" or "**REL 2**" in the display – if the status fields do not light up, the extra functions are not specified.

**Note**

The programming of extra functions is saved along with storage of heating programs!

## 6.5 Programming Extra Functions in "T3" (C 280 only)

When programming extra functions in the program value "**T3**" (C 280 only), the extra function stays turned on after conclusion of the program, for instance in order to continue cooling the furnace with a cooling fan.

Extra functions which are automatically turned on during program execution by "**T3**" must be turned off by hand if necessary.

## 6.6 Turning Extra Functions in Program Execution on and off by Hand

Extra functions can be turned on or off during a started program, for the active segment or after termination of the program, by pressing the corresponding "**Extra**" key.

If an extra function is turned on during a running program, it remains on until the program-specific segment transition to the following segment occurs.

## 6.7 Saving Programs

Changed settings are initially only buffered. That is, buffered programs are overwritten once a different program is called up. If a changed or new program should be permanently saved in the controller for more frequent use, it can be saved to a permanent program slot as follows:

Press the save key – a program number appears in the display.

The number can be changed to the desired program number using +/-.

Pressing the save key again finally saves to the selected program slot.

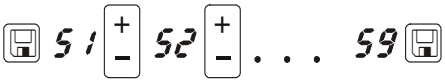



Fig. 13: Saving a program to program slot no. 9

The program can now be called up from this storage slot at any time (see Program start)

**Note**

Existing heating programs already saved in a storage slot will be overwritten with no message or warning. Saved heating programs are still retained after the controller is turned off. Configured waiting times are not saved. They must be reentered before each process! The controller automatically returns to the display of the furnace temperature after about 10 seconds when you save without pressing the save key again. The program is only buffered in this case.

## 6.8 Preconfigured Programs for the B 130/C 280

The following programs are preconfigured and can be started directly.

"Baking" refers to the baking of clay, while "glazing" refers to the baking of glazes.

**Note**

In any case, note the specifications and instructions of the raw material manufacturers, which may make it necessary to change or adapt the preconfigured programs. It cannot be guaranteed that optimum results can be obtained with the preconfigured programs. The configured factory programs can be overwritten for your own purposes (see Setting programs/wait time).

**B 130**

| ➔ | T1 | Time1 | T2 | Time2 | Time3 | Time4 | T3 | |
|---|---|---|---|---|---|---|---|---|
| P1 | 650 | 6:00 | 900 | 0:00 | 0:20 | 0:00 | 0 | Baking |
| P2 | 500 | 3:00 | 1050 | 0:00 | 0:20 | 0:00 | 0 | Glazing |

**C 280**

| ➔ | T1 | Time1 | T2 | Time2 | Time3 | Time4 | T3 | |
|---|---|---|---|---|---|---|---|---|
| P1 | 650 | 3:00 | 900 | 0:00 | 0:20 | 0:00 | 0 | Baking 1 |
| P2 | 650 | 6:00 | 900 | 0:00 | 0:20 | 0:00 | 0 | Baking 2 |
| P3 | 650 | 5:00 | 1100 | 0:00 | 0:30 | 0:00 | 0 | Baking 3 |
| P4 | 320 | 2:00 | 1050 | 0:00 | 0:20 | 0:00 | 0 | Glazing 1 |
| P5 | 500 | 3:00 | 1050 | 0:00 | 0:20 | 0:00 | 0 | Glazing 2 |
| P6 | 500 | 3:00 | 1200 | 0:00 | 0:20 | 0:00 | 0 | Glazing 3 |
| P7 | | | | | | | | Unused |
| P8 | | | | | | | | Unused |
| P9 | | | | | | | | Unused |

**Note**

For furnace models with lower maximum temperatures, the programs listed above are adapted at the factory to the maximum temperature of the furnace.

## 6.9 Calling Programs

Call up saved programs with the P key. Use the + − key to select the desired program number and control the program using the → key.

Fig. 14: Calling heating program no. 9

**Note**

Check the heating program called up before starting it, to be sure that it is the right heating program.

As of version 3, heating programs are reloaded after program termination.That is, the heating program can be started after a process without having to reenter it. Turn the controller off and on again briefly to be able to read the version number .

## 6.10 Program Start

After a heating program is entered or called up, it can be started with the start stop key.

**As of version 3:** if the furnace temperature at the starting time is higher than the temperature specified in "T 1", the controller first waits until the temperature of the warm furnace has fallen to the first segment temperature T1, and only then does it start the rest of the program's execution. (See also Chapter "New functions of the Nabertherm controller"). For a cold furnace, the heating program is started immediately.

If the heating program has been started, during program execution the LED of the active segment "time 1 – time 4" lights up. The controller regulates the configured temperature profile completely automatically and the status field "**heat**" lights up in the heating cycle.

If the waiting time is set, the LED "**wait**" first lights up and the display counts down the remaining waiting time. The status field "**heat**" only lights up after program start in segment "**time 1**" if the heater is turned on. After conclusion of the last segment, the heater is turned off and the program terminates. In the display, the end of the program is indicated with the message "**end**".

## 6.11 Program Change during Execution

During program execution, program changes can be made as follows:

Use the paging key → to enter input mode. Every push selects the following segment or time value. The selected value is displayed with the blinking LED for either "**T**" or "**time**".

In the display, the temperature value "**T**" or time value "**time**" corresponding to the flashing LED is shown. Holding times can be changed in steps of 5 minutes and temperatures by +/- 1 °C/°F. If the value displayed should not be changed, use the page key → to page to the next segment or time value. All temperature and time values, as well as the extra functions, can be changed; the only exception is the segment time of the ramp currently being processed.

**Note**

Changes to individual values during program execution must be confirmed with . Otherwise, the change will not be accepted. If you only want to change the active holding time segment, this can be done without selecting using the paging key . To do this, you can use the key directly to increase or decrease the holding time in steps of five minutes.

Extra functions can be turned on or off during a started program, for the active segment or after termination of the program, by pressing the corresponding "**Extra**" key.

## 6.12 Terminating a Program

To terminate a program, press the start stop key again. The heater is turned off and the status field "**end**" lights up. Program termination can be performed at any time.

**Note**

It is not possible to interrupt a program temporarily!

## 6.13 Key Locking

For protection against unintended or unallowed changes to the program execution, the keyboard can be locked after program start using the "key lock". Key locking can only be released by turning the controller off and on again. If the furnace is turned off while a program is running, see the power failure behavior.

## 6.14 Info Menu

From the info menu, the current program status, program-relevant information, and fault messages can be read out.

You can reach the info menu by pressing the "**Info**" key.

Use the "**Info**" key to page through the entire info menu until the furnace temperature is displayed again.

| | |
|---|---|
| Pr | Selected program |
| SP | Set temperature value |
| Pt | Program run time of the active/last program, in minutes |
| E | Power consumption of the active/last program, in kW/hr |
| tt | Total operating hours |
| OP | Heating output power in % |
| F1 | Fault buffer of last fault |
| F2 | Fault buffer of next to last fault |

Ht Highest program temperature of the active/last program

tA Maximum furnace temperature

**Note**

The info menu is **not automatically** switched back to the temperature display, so that you can observe it for longer periods of time.
Use the "**Info**" key to page through the entire info menu until the furnace temperature is displayed again.
Some values are reset after a heating program is started.
The operating hour counter cannot be reset

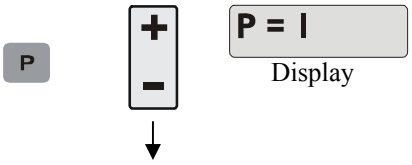
# 7 Controller B 150/C 290/C 295

## 7.1 Brief Instructions

**Turning on the controller**

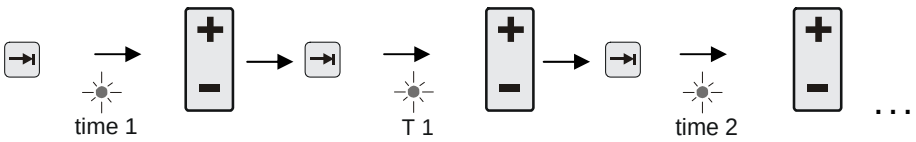
Display — Version number — Temperature display

**Call program**




Confirm program selection with ⇥

**Enter / control program**




**Start program**

Display

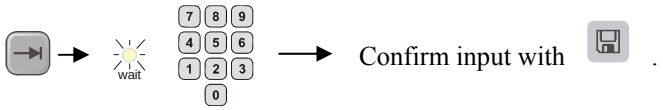
# 8 Controller B 180/P 330

## 8.1 Brief Instructions

**Turning on the controller**

Display — Version number — Temperature display

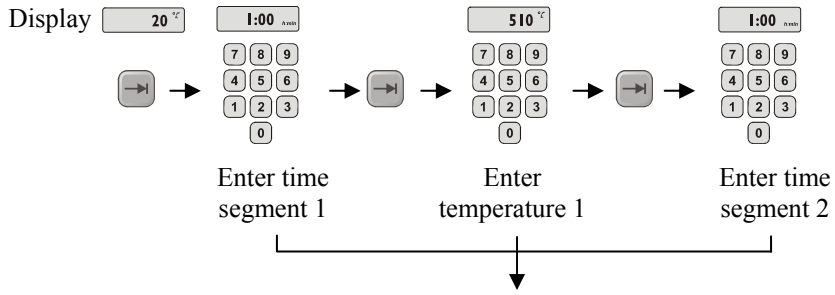
**Enter waiting time**




Confirm input with .

Enter waiting time

**Enter program**




Enter time segment 1 — Enter temperature 1 — Enter time segment 2

Confirm input with .

**Start program**

Display

## 8.2 Setting and Displaying the Date/Time on the P 330

The P 330 has a real time clock that is set at the factory. The time of day can be displayed by pressing the key. If the time of day is displayed incorrectly, the clock can be set as follows: The clock is set using a numerical combination of the day of the week and the time. The setting of the day of the week corresponds to the first digit of the numerical combination. Each day of the week has its own number.

1=Mon, 2=Tue, 3=Wed, 4=Thu, 5=Fri, 6=Sat, 7=Sun.

Entry of the time of day must then be carried out with the last four digits of the combination using a 24-hour clock:

E.g. 0735 for 7:35 AM, 1700 for 5:00 PM, etc.

Example: Setting the time "Wednesday (day 3), 7:35 AM"

Fig. 15: Example of setting the clock

The day and time are saved by pressing the key. They can be queried at any time with the symbol key .

This clock is a real-time clock, that is, even when the controller is turned off, the time is retained using a built-in battery. The lifetime of the battery is about 3 years. When the battery is replaced, the saved data (set time) is lost. For the battery type, see the chapter "Technical data".

The time can only be entered and displayed in 24-hour mode, that is, a display of 12:00 AM/PM is not possible. After the time is set, the controller is fully ready for operation.

## 8.3 Setting or changing Programs

For the automatic operation of the furnace, before starting the controller a temperature characteristic must be configured which describes the desired temperature behavior. This configured temperature behavior is also called a heating program.

**C 290/C 295**

Each of the 9 heating programs for the C 290/C 295 has 20 ramps and 20 hold times (40 segments in all) which are connected together with the segment blocks **A – I**.

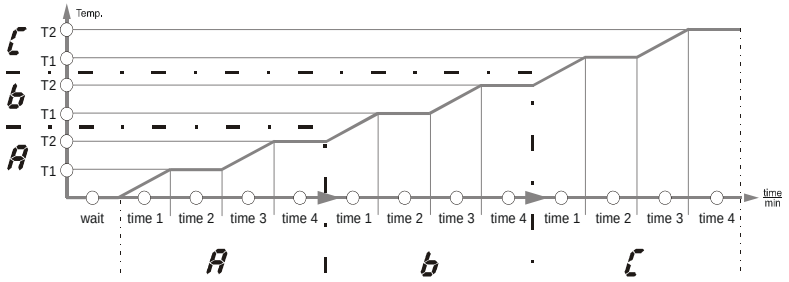



Fig. 16: Program graphic, C 290/C 295

**B 150**

The heating program for the B 150 has one ramp and one holding time.

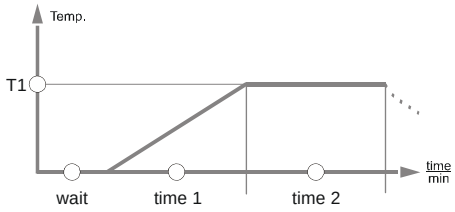


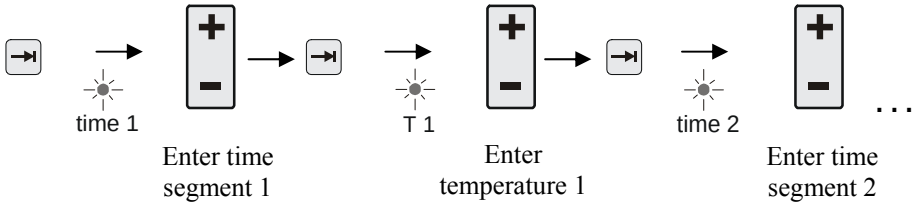

Fig. 17: Program graphic, B 150

- In a **Ramp**, a segment temperature "**T**" and a segment time, e.g. "**time 1**", define a linear temperature increase (slow heating).
- In a **holding time,** e.g. "**time 2**", it is configured how long the temperature value configured in "**T 1**" should be held.

**Program Entry**

Using the paging key ⇥ you can enter input mode. Every push selects the following segment or time value. The selected value is displayed with the flashing LED for either "**T**" or "**time**".

**Enter / control program**




**Note**

For the controllers **B 180** and **P 330** the values are entered at the **numerical block.**

In the display, the corresponding segment block **A-I** and the temperature value "**T**" or time value "**time**" corresponding to the flashing LED are also shown.

If the value displayed should not be changed, use the page key to page to the next temperature or time value.

The display also shows the unit of the value expected:

- set temperature values with **°C/°F**

- set time specifications with **hr:min**

- set gradient specifications with **°C/hr:min** or **°F/hr:min**

If a value should be changed, you can set it with the key.

Each time you press the key, the value changes by 1 °C or by one minute.

If you hold the key down, the value first changes in steps of 10,

and if you hold the key down for a longer time, the value changes in steps of 100.

Entry of times is done in hours and minutes, e.g.**6 hr** and **30** min as **06:30**.

For holding times, an entry of **99:59** means program execution will continue forever. When input is complete, the program can be started (see Starting the program).

If ramps contain the time entry **00:00**, the controller attempts to reach the temperature value stored in "T" as quickly as possible

If no key is pressed for 60 seconds, the display automatically returns to the display of temperature. Changed settings are initially only buffered. If a changed or new program should be permanently stored in the controller for more frequent use, see "Saving programs".

**Note**

Not all segments have to be programmed. For segments which are not needed, the temperature and time values must be set to "**0**". The controller then automatically ends the program after the last segment programmed

**Note**

For the controllers **B 180** and **P 330** the values are entered at the **numerical block.**

## 8.4 Setting or changing the Waiting Time

**Waiting time B 150/C 290/C 295/B 180**

To start a heating program automatically at a later point in time, e.g. after a drying time, a waiting time "**wait**" can be programmed.

To select the waiting time, press the **key** repeatedly until the wait LED flashes.

The entry of times is in hours and minutes, e.g. 6 hrs and 30 min as 06:30, i.e., when a heating program is started, first the wait time elapses and only then does the program start with segment 1 and heating.

## 8.5 Setting or changing the Start Time

**P 330 start time**

To start a heating program automatically at a later point in time, e.g. after a drying time, a waiting time can be programmed via the 7-day timer.

To select the waiting time, press the **key**.

The "wait" LED flashes.

The timer is set using a numerical combination consisting of the day of the week and the time. The setting of the day of the week corresponds to the first digit of the numerical combination. Each day of the week has its own number.

1=Mon, 2=Tue, 3=Wed, **4=Thu**, 5=Fri, 6=Sat, 7=Sun.

Entry of the time of day must then be carried out with the last four digits of the combination using a 24-hour clock:

e.g. **0800** for **8:00 a.m.**, 1800 for 6:00 p.m., etc.

Also see "Setting and displaying the date/time"

Example: Program start on Thursday at 08:00.

Fig. 18: Waiting time input Display

**Note**

Incorrect input:

Exit Wait function by pressing the **key**. Press again to select or correct the wait time.

## 8.6 Programming Extra Functions

With controllers of types "**C**" and "**P**", up to two optional extra functions "**Extra 1**" and "**Extra 2**" can be turned on or off in the segments depending on the program

Extra functions are, for instance, exhaust air flaps, fans, solenoids, or optical and acoustic signals, which have been included in the furnace (if applicable, see additional operating instructions for extra functions)

These extra functions can be specified during program entry in all segments, e.g. "**time 1**", by selecting the "**Extra 1**" or "**Extra 2**" key.

That is, when the controller processes the programmed segment, the extra functions are automatically turned on and then turned back of in the next segment, for instance.

Programming of extra functions is done during program entry.

The desired segment must be selected as described in "Entering programs/wait time", so that the corresponding LED, e.g. "**time 1**", is flashing.

If the "**Extra 1**" or "**Extra 2**" key is now pressed, the extra function is specified for this segment, and in the display the status field "**REL 1**" lights up for "**Extra 1**" and/or "**REL 2**" for "**Extra 2**". During program execution, the programmed extra function is automatically turned on during this segment.

To turn off the specification of an extra function, press the corresponding "**Extra**" key again – in the display, the status field "**REL 1**" or "**REL 2**" disappears – the extra function is now no longer turned on. Both extra functions can also be activated at the same time.

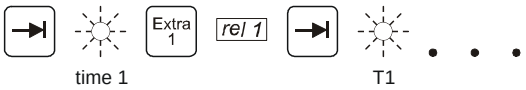



Fig. 19: Selection of "**Extra 1 funktion**" in segment "**time 1**"; LED "**time 1**" flashes

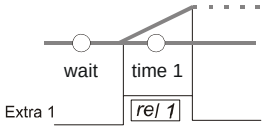



Fig. 20: In the display, "**REL 1**" lights up for the selected "**Extra 1 funktion**"

When paging through the program with , programmed extra functions are indicated in each segment ("**time**" LED flashing) with the status fields "**REL 1**" or "**REL 2**" in the display – if the status fields do not light up, the extra functions are not specified.

**Note**

The programming of extra functions is saved along with storage of heating programs!

**Note**

The P 330 has an acoustic alarm coupled to Extra Relay 1. This means that when the Extra 1 function is activated the acoustic alarm sounds and when the Extra 1 function is deactivated the alarm turns off.

## 8.7 Turning Extra Functions in Program Execution on and off by Hand

Extra functions can be turned on or off during a started program, for the active segment or after termination of the program, by pressing the corresponding "**Extra**" key.

If an extra function is turned on during a running program, it remains on until the program-specific segment transition to the following segment occurs.

## 8.8 Saving Programs

Changed settings are initially only buffered. That is, buffered programs are overwritten once a different program is called up. If a changed or new program should be permanently saved in the controller for more frequent use, it can be saved to a permanent program slot as follows:

Press the save key – a program number appears in the display.

The number can be changed to the desired program number using .

Pressing the save key again finally saves to the selected program slot.

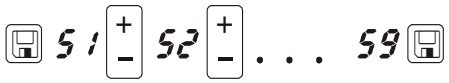



Fig. 21: Saving a program to program slot no. 9

> **Note**
>
> For the controllers **B 180** and **P 330** the values are entered at the **numerical block.**

Fig. 22: B 150 example programs

The program can now be called up from this storage slot at any time (see Program start)

> **Note**
>
> Existing heating programs already saved in a storage slot will be overwritten with no message or warning. Saved heating programs are still retained after the controller is turned off. Configured waiting times are not saved. They must be reentered before each process! The controller automatically returns to the display of the furnace temperature after about 10 seconds when you save without pressing the save key again. The program is only buffered in this case.

## 8.9 Calling Programs

Call up saved programs with the P key. Use the + − key to select the desired program number and control the program using the → key.

Fig. 23: Calling heating program no. 9

> **Note**
>
> For the controllers **B 180** and **P 330** the values are entered at the **numerical block.**

> **Note**
>
> Check the heating program called up before starting it, to be sure that it is the right heating program.
>
> As of version 3, heating programs are reloaded after program termination.That is, the heating program can be started after a process without having to reenter it. Turn the controller off and on again briefly to be able to read the version number .

## 8.10 Program Start

After a heating program is entered or called up, it can be started with the start stop key.

**As of version 3:** if the furnace temperature at the starting time is higher than the temperature specified in "T 1", the controller first waits until the temperature of the warm furnace has fallen to the first segment temperature T1, and only then does it start the rest of the program's execution. (See also Chapter "New functions of the Nabertherm controller"). For a cold furnace, the heating program is started immediately.

If the heating program has been started, during program execution the LED of the active segment "time 1 – time 4" lights up. The controller regulates the configured temperature profile completely automatically and the status field "**heat**" lights up in the heating cycle.

If the waiting time is set, the LED "**wait**" first lights up and the display counts down the remaining waiting time. The status field "**heat**" only lights up after program start in segment "**time 1**" if the heater is turned on. After conclusion of the last segment, the heater is turned off and the program terminates. In the display, the end of the program is indicated with the message "**end**".

## 8.11 Program Change during Execution

During program execution, program changes can be made as follows:

Use the paging key ⇥ to enter input mode. Every push selects the following segment or time value. The selected value is displayed with the blinking LED for either "**T**" or "**time**".

In the display, the temperature value "**T**" or time value "**time**" corresponding to the flashing LED is shown. Holding times can be changed in steps of 5 minutes and temperatures by +/- 1 °C/°F. If the value displayed should not be changed, use the page key ⇥ to page to the next segment or time value. All temperature and time values, as well as the extra functions, can be changed; the only exception is the segment time of the ramp currently being processed.

**Note**

Changes to individual values during program execution must be confirmed with 💾. Otherwise, the change will not be accepted. If you only want to change the active holding time segment, this can be done without selecting using the paging key ⇥. To do this, you can use the + - key directly to increase or decrease the holding time in steps of five minutes.

Extra functions can be turned on or off during a started program, for the active segment or after termination of the program, by pressing the corresponding "**Extra**" key.

**Note**

For the controllers **B 180** and **P 330** the values are entered at the **numerical block.**

## 8.12 Brief Program Interruption on the P 330

To interrupt program execution only temporarily, for instance to open the furnace door for removal or addition of material, press the "**pause**" key. Unlike the "**start/stop**" key the heating is still turned off, but the program is not reset (regulation data is retained).

The program is continued with the "**start/stop**" key in the last active segment, taking the elapsed time in that segment into account.

If the furnace door is opened without the pause function, the controller immediately reacts to the temperature drop and starts to heat immediately after the door is shut – the result can be an overcompensation in the furnace chamber temperature (see also "Safety" in the furnace operating instructions).

## 8.13 Terminating a Program

To terminate a program, press the key again. The heater is turned off and the status field "**end**" lights up. Program termination can be performed at any time.

**Note**

It is not possible to interrupt a program temporarily!

## 8.14 Segment Skip Key (C 290, C 295 only)

Using the key, the current segment can be shortened or accelerated as follows:

**Segment skip in a ramp**

If the program is in a ramp, the key sets the corresponding ramp time (e.g. "**time 1**" or "**time 3**") to zero, so that the controller attempts to reach segment temperature "**T**" as quickly as possible using maximum power and maximum gradients. After the segment temperature is reached, the segment advances.

**Segment skip in the holding time**

If the "**Segment skip**" key is pressed during a holding time (e.g. "**time 2**" or "**time 4**"), then the holding time is ended immediately and the controller jumps directly into the next segment.

## 8.15 Heating Circuits Key (C 295 only)

The key can be used to adapt the power of two heating circuits individually to the process. The controller has two heater outputs whose relationship to one another can be adjusted by selectively reducing the two output lines. At delivery, both heating outputs are set to 100% output power.

By pressing the key, the configured relationship in the table is initially shown. The key can be used to change this relationship.

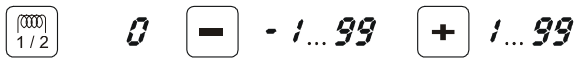



Fig. 24: Setting the heating circuit relationship

| Display | -100 | -90 | -80 | -70 | -60 | -50 | -40 | -30 | -20 | -10 | 0 | +10 | +20 | +30 | +40 | +50 | +60 | +70 | +80 | +90 | +100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A1** | 0 % | 10 % | 20 % | 30 % | 40 % | 50 % | 60 % | 70 % | 80 % | 90 % | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| **A2** | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 90 % | 80 % | 70 % | 60 % | 50 % | 40 % | 30 % | 20 % | 10 % | 0 % |

**Examples:**

1) At the setting "+ 1001", the furnace is heated only through output 1 (**A1**), for instance for a furnace for fusing applications, if only the ceiling heat is to be used and the side or floor heater is to be turned off. Note that when operating with reduced heating power, the furnace may no longer be able to reach the maximum temperature specified on the type plate!

2) At setting "0", the furnace is operated with both heat outputs without reduction, for instance for an even temperature distribution when baking clay and ceramics.

3) At setting "-100", output 1, for instance the ceiling heat in fusing furnaces, is turned off. The furnace is heated only through the heater attached to output 2 (**A2**), e.g. the side and floor (see the furnace description). Note that when operating with reduced heating power, the furnace may no longer be able to reach the maximum temperature specified on the type plate! Since the configuration of the output power is process-dependent, these settings can be saved directly in the heating program. First enter the heating program as described, and then press the 1 / 2 key to specify the relationship between heating outputs. By saving the heating program, the entire programming including the configured output power can be assigned to a program memory (see also "Saving programs"). The settings for the output power can also be controlled or changed at any time by pressing the 1 / 2 key. If there is no other input for 30 seconds, e.g. with the + − keys, the display switches back to display of the temperature.

**Note**

See the furnace instructions for which output (**A1**) (**A2**) is responsible for which heating zone. In furnaces with two heating circuits, **output 1** always corresponds to the upper heating circuit and **output 2** to the lower one.

## 8.16 Info Menu

From the info menu, the current program status, program-relevant information, and fault messages can be read out.

Info

You can reach the info menu by pressing the "**Info**" key.

Use the "**Info**" key to page through the entire info menu until the furnace temperature is displayed again.

| | |
|---|---|
| Pr | Selected program |
| SP | Set temperature value |
| Pt | Program run time of the active/last program, in minutes |
| E | Power consumption of the active/last program, in kW/hr |
| tt | Total operating hours |
| OP | Heating output power in % |
| F1 | Fault buffer of last fault |
| F2 | Fault buffer of next to last fault |

Ht Highest program temperature of the active/last program

tA Maximum furnace temperature

**Note**

The info menu is **not automatically** switched back to the temperature display, so that you can observe it for longer periods of time.
Use the "**Info**" key to page through the entire info menu until the furnace temperature is displayed again.
Some values are reset after a heating program is started.
The operating hour counter cannot be reset

**Note**

For quick assistance in the event of a fault, the data in the info menu are very useful for localizing the fault. In case of a malfunction, please fill out the check list printed from the section "**Check List for Controller Complaints**" and provide it to us.

# 9 Power Failure Behavior for Version 3.xx Controllers and higher

The power failure behavior describes the behavior of the contorller when the power supply is interrupted. The duration of the power failure is irrelevant.

**Ceramic/glass applications**

- Program stop in wait segment with fault message F90
- Termination in all other segments with fault message F90
- Continuation from actual value in ramps if T > 100 °C

**Metal/laboratory applications**

Program continuation in any program state.

The power failure behavior configured can be checked or changed under Setting/checking power failure behavior (as of version 3.xx)

# 10 Power Failure Behavior for Controller Versions 1-2.xx, built through the beginning of 2007

**Note**

The power failure fault message is only displayed after the first power failure. If multiple power failures in a row occur during a program, this can only be detected by the fact that the "**end**" indicator is not lit.

## 10.1 Power Failure Behavior in the different Segments of B 130, C 280

| | |
|---|---|
| **wait/time3/time4:** | Program stop with fault message F90 |
| **time1/time2:** | Continuation of program |

## 10.2 Power Failure Behavior for the B 150

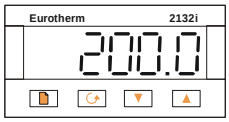
| | |
|---|---|
| **wait:** | Program stop with fault message F90 |
| **time 1:** | Continuation of program from actual value |
| **time 2:** | Program stop if holding time less than 99:59 |
| **time 2:** | Continuation of program if holding time set to 99:59 |

## 10.3 Power Failure Behavior for C 290, C 295

| | |
|---|---|
| **wait:** | Program stop with fault message F90 |
| **time 1, time 3:** | For T < 450 °C (842 °F), continuation of program rt |
| **time 1, time 3:** | For T > 450 °C (842 °F), stop |
| **time 2, time 4:** | Program stop if holding time less than 99:59 |
| **time 2, time 4:** | Continuation of program if holding time set to 99:59 |

# 11 Eurotherm 2132i Over-Temperature Limit Controller for Installing in Controllers B 180 and P 330 (optional)

## 11.1 Eurotherm 2132i Over-Temperature Limit Controller




The Eurotherm 2132i over-temperature limit controller monitors the furnace chamber temperature using an independent measurement circuit. If the furnace chamber temperature rises above the configured value (generally Tmax + 30°C/86°F), the heater is turned off by a safety fuse to protect the furnace – "FSH" alarm flashes on the over-temperature limit controller.

If the temperature falls back below the configured value, it must be acknowledge for operation to resume. To do this, the keys and must be pressed simultaneously on the over-temperature limit controller in order to enable the heater again.

A temperature selection monitor (option for melting furnaces), unlike the temperature selection limiter, can turn the heating back on after it exceeds the limit. No acknowledgment is necessary.

**Note**

The overtemperature limiter and overtemperature selection monitor (optional) must be checked for proper functioning at regular intervals!

**Note**

See Eurotherm 2132i instructions

# 12 Configuration/Customer-Specific Settings

## 12.1 Configuration

Particular settings which influence the operating behavior of the controller are performed in the configuration. The configuration is divided into two access levels which can be opened with different passwords.

Level 1 = Password **0** Level 2 = Password **2**

## 12.2 Opening the Configuration for the B 130, B 150, C290, C 295

Hold the Info **key** down and briefly press the > **key**, then release the Info key again. The display shows "**Co 0**" and waits for the entry of the security code.

Use to enter the password for the desired configuration level and confirm with the save key . Page with the key to show the parameters one after another.

Changed settings must be saved with the key! During the storage process, the value blinks briefly in the display.

## 12.3 Opening the Configuration on the B 180/P 330

Hold the **key** down and briefly press the **key**. "**Co 0**" appears in the display, and the system waits for the entry of the password.
Use the **keyboard block** to enter the password for the configuration level desired and confirm with the key.
Page with the **key** to show the parameters one after another.
Changed settings must be saved with the **key**! During the save process, the value flashes briefly in the display.

**Note**

By changing regulation parameters, the function of the control unit can be significantly influenced.

## 12.4 Configuration Options in Configuration Level 1 (Password = "0")

### 12.4.1 Converting °C/°F

On the configuration level, enter the password "**0**" and select the parameter "**°F**", use or the key block to set it to "**1**" and confirm with the save key .

The safety shutoff in the controller is automatically converted, but all other temperature specifications must be changed to **°F**.

The **preset** and **subsequent** heating programs are always programmed in **°C** and must be manually adapted after the conversion.

### 12.4.2 Settings for kW/h Counter

For the calculation of electrical power consumption in kW/h in the info menu, you must enter the furnace power from the type plate. The setting is generally already made by Nabertherm.

If this is not the case, select the parameter "**PF**" in the configuration level and enter the type plate power x 10 with or the key block and confirm with the save key .

Example: furnace power 3.6 kW * 10 = "**36**" should be entered.

### 12.4.3 Setting the Interface Address

When operating multiple controllers in a data network, different addresses must be configured for the controllers.

On the configuration level, select parameter "**Ad**", enter the new address (1...99) with or key block, and confirm with the save key .

**Note**

When operating the controller with furnace monitor software "MV Controltherm", the interface address may not be set higher than 16

### 12.4.4 Program Entry with/without Gradient (as of Version 3.xx)

Select the parameter "**rA**" in the configuration level, use or the key block to set the desired input mode, and use the save key to confirm.

**0** = input of ramps without gradient over time and set temperature
**1**= input of ramps with gradient and set temperature

**Note**

The unit of time for the gradient input is preset to **hours** (h) and cannot be changed to minutes.
Example: 100°C/**h**

### 12.4.5 Setting/Control of Power Failure Behavior (Version 3.xx or later)

In the configuration level, select parameter "**Ur**", set the desired power failure behavior with or the **key block**, and confirm with the save key .

**0** = e.g. ceramic/glass applications

Interrupt in wait segment

Interrupt in all segments,

continuation from actual value in ramps at T > 100°C

**1** = e.g. metal/laboratory applications

Program continuation in any program state.

Hold times are not repeated, but are continued from the time of the power failure with the remaining time.

## 12.5 Configuration Options in Configuration Level 2 (Password = "2")

PA active parameter set

Configuration range 0 to 4 (see also auto tune)

TU Auto tune

Configuration range 1 (start)

P1 Proportional range XP of the 1st parameter set

Configuration range from 0 to 100 %

I1 Settle time Tn for the 1st parameter set

Configuration range from 0 to 5000 sec

D1 Hold-back time Tv for the 1st parameter set

Configuration range from 0 to 250 sec

following parameters sets P2, i2, d2 ... P4, i4, d4

## 12.6 Auto Tune

The regulation parameters of the controller are already set at the factory for the optimum regulation of the furnace. If the regulation behavior is still not sufficient for your process, the regulation behavior can be improved using auto tune.

The controller has four different parameter sets which are already configured for different furnace models. The configured parameter set can be seen in parameter "**PA**" (see also Configuration). When performing auto tune, the regulation parameters of the selected parameter set are determined and stored using a special measurement procedure.

Start the auto tune process only with a cooled furnace (T < 60°C), since otherwise incorrect parameters will be determined for the regulation segment. On the program input level first enter a value for "**T1**" at which the temperature is to be optimized. Set all times "time" to "00:00"n.

In configuration level 2, select parameter "**tu**", set it to "**1**", and confirm with the key. This will start the auto tune and "**tune**" will alternate with the furnace temperature in the display. Once the optimization is complete, the status field "**end**" will show in the display. The parameters determined are stored by the controller into the parameter set for the corresponding temperature range.

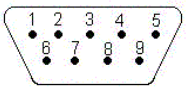
Auto tune is always performed at about 70% of the value set in "**T1**" in any case, to avoid destruction of the furnace, for instance when optimizing the maximum temperature. Auto tune may take more than 3 hours for some models, depending on the furnace type and temperature range. The regulation behavior may be degraded in other temperature ranges after an auto tune! Nabertherm assumes no liability for damage caused by manual or automatic changes to the regulation parameters (see also Temperature-dependent parameter sets).

**Note**

Perform an auto tune, if necessary, for all temperature ranges.

# 13 Data Interface

## 13.1 RS-422 Data Interface (optional)




All controllers can be equipped with a RS-422 data interface, which is optionally implemented with a 9-pin D-Sub connector. This interface can be used to send or receive both control functions and archival data. Data exchange is indicated by the "com" (PC communication) indicator in the display.

The interface is immediately ready for operation; e.g for the Nabertherm furnace monitoring software "Controltherm MV"

When operating multiple controllers/furnaces on a data network, the interfaces must be set to different addresses and changed if necessary (see Setting the interface address).

**Note**

If the data connection line between the furnace and the PC or notebook must be longer than 20m, an optionally available interface power supply (order no. 540100193) may be necessary to avoid communication errors.

If the Nabertherm furnace monitor package "MV-Controltherm" is not used, the RS422 interface must be equipped with an additional +5 volt power supply. The power supply is needed by the galvanically isolated driver components of the controller. For this purpose,

for instance, an external interface switching power supply for the 9-pin D-Sub plug connector can be ordered (order number 540 100 193).

# 14 Faults

## 14.1 Fault Messages

If a fault message occurs, one of the following fault messages (fault codes) is displayed:

| Fault code | Meaning | Comment |
|---|---|---|
| **F 10** | The furnace is not reaching the configured temperature. | E.g. heater defective, door not closed, or door contact switch incorrectly adjusted. |
| **F 30 – 32** | Fault in thermocouple or measurement circuit. | Thermocouple defective. |
| **F 40** | Thermocouple polarity reversed. | E.g. after replacement of thermocouple – switch polarity. |
| **F 50** | Specification of temperature or time incorrect | Correct entry. |
| **F 60 – 61** | Controller system fault | Controller defective. |
| **F 62** | Ambient temperature too low <-10 °C (-50 °F) | Heat room if necessary. |
| **F 63** | Ambient temperature too high > 70 °C (158 °F) | Ventilate room if necessary. |
| **F 64 – 69** | Controller system fault | Controller defective. |
| **F 70** | Furnace temperature has exceeded the permitted value "Tmax" | Switching system or controller defective |
| **F 90** | Power failure | Appears after power restored |

Fault messages can be reset by turning the power switch off and back on. Leave the unit switched off for at least 5 seconds. If the fault message no longer occurs within a minute after power is turned on, the controller is ready to operate. If there is another fault message, contact Nabertherm service. Ventilation motors (if present) remain on even in case of a fault. The heater is always turned off.

## 14.2 Fault Diagnosis

| Fault | Cause | Action |
|---|---|---|
| **Controller does not light up** | Controller turned off | Power switch to "**I**" |
| | No power available | Power plug in outlet?<br>Check building circuit breaker/fuse |
| **Furnace not heating** | Door/lid open | Close door/lid |
| | Door contact switch actuated | Check door contact switch |
| | "**wait**" displayed | Set waiting time to "00:00" |
| | No temperature input | Check temperatures T1/T2 |
| **Program doesn't go to next segment** | In one time segment, the holding time is set to infinity | Set a holding time less than 99:59 |
| **Regulator doesn't heat during optimization** | No temperature set in "T1" | The temperature to optimize must be entered in "T1" |

## 14.3 Check List for Controller Complaints

Customer: _____

_____

_____

Furnace Type: _____ Furnace Serial No.: _____

Controller Type: _____ Controller Serial No.: _____

Controller Version: _____

| | |
|---|---|
| Controller error message: | Description: |
| These faults depend on external factors: | F 62 Ambient temperature too low <-10 °C (-50 °F)<br>F 63 Ambient temperature too high > 70 °C (158 °F)<br>F 90 Power failure |
| Exact fault description: | |
| Info menu, parameter F1 | |
| Info menu, parameter F2 | |
| Info menu parameter Ht | |
| Regularity of occurrence: | At certain segments in the program or at specific times of the day:<br><br>At certain temperatures: |
| When did the failure occur first? | ☐ Fault is new<br>☐ Fault has been occurring already a certain time period<br>☐ Unknown |
| Fault frequency: | ☐ Fault occurs often<br>☐ Fault occurs in regular intervals<br>☐ Fault occurs rarely<br>☐ Unknown |
| Replacement controller: | Has the controller already been replaced? ☐ yes ☐ no<br>Did the same fault happen with replacement controller? ☐ yes ☐ no<br>Has the error message list been consulted (see furnace and controller manuals) ☐ yes ☐ no |

_____ _____ _____

Date Name Signature

# 15 Replacement Parts

## 15.1 Replacing a Built-in Controller

**Warning! Danger due to electrical current!**

Work on the electrical systems may only be performed by a qualified electrician!
Replacement may only be performed by a technical expert!

**Note**

Be sure that the power switch is on "**0**"!
Always unplug the power cord before opening the housing!
If the furnace does not have a power cord, disconnect the power to the fixed connection.

### Disassembly

- Remove the 4 screw fasteners from the front side of the controller.
- Tilt the top of the controller carefully out of the housing.
- If present, pull the connector of the flat flexible cable for the interface
- Disconnect the grounding conductor (green/yellow) at the controller.
- Pull both plug connectors (orange).
- Pull the controller gently by the wires out of the housing

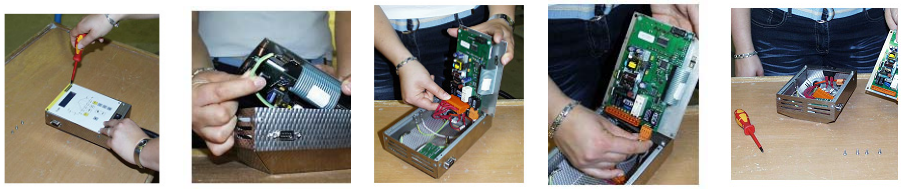


Fig. 25: Replacing a controller

### Assembly

- Plug both plug connectors onto the new controller.
- Fasten the ground connector to the controller.
- Check the ground connections of the orange and gray measurement lines.
- If applicable, fasten the plug of the interface line.
- Check for correct connection of the grounding conductor before installing the controller.
- Place the controller back into the installation space.
- Check that no cables are protruding or caught.

**Warning! Danger due to electrical current!**

Work on the electrical systems may only be performed by a qualified electrician!
Replacement may only be performed by a technical expert!

**Note**

Batteries and electrical parts do not belong in ordinary garbage. Never dispose of batteries in fire, since they can leak or explode. Dispose of unusable material at the appropriate disposal facility. Follow national environmental regulations!

## 16 Technical Data

The electrical data are located on the type plate on the side of the furnace.

| | | |
|---|---|---|
| **Supply voltage** | ~100 V – 240 V 50/60 Hz | |
| **Power consumption** | 3.5 W | |
| **Sensor input** | Type S, K, R | |
| **Sensor input** | Type B | only B 180/C 295/P 330 |
| **Heater output 1** | 12 V, max. 130 mA | |
| **Heater output 2** | 12 V, max. 130 mA | C 295 only |
| **Heater output 3** | Continuous 0 – 5 V, 0 – 10 V | C 295 only |
| **Safety relay** | ~250 V/16 A | |
| **Extra relay** | ~250 V/3 A | not B 130 |

| | | |
|---|---|---|
| **Real-time clock** | | P 330 only |
| **Buzzer** | | P 330 only |
| **Battery** | 3 V/285 mA Lithium Model: CR2430 | P 330 only |

| | | |
|---|---|---|
| **Protection rating:** | I (protective ground) | |
| **Protection class:** | Keyboard film IP 65 | |
| | Installation housing IP 20 | |
| | Furnace/switching system | (see furnace operating instructions) |

| | | |
|---|---|---|
| **Interface** | RS 422 isolated | optional |

| | | |
|---|---|---|
| **Measurement accuracy:** | +/- 3°C | |
| **Lowest possible rate** | 0.25°C/hr | |

| **Ambient conditions** | | |
|---|---|---|
| Storage temperature | - 20°C to + 75°C | |
| Working temperature | 0 to 40°C | Ensure sufficient air circulation |
| Relative humidity: | 5 – 90 % | not condensing |

# 17 Electrical Connections (Wiring Diagram)

## 17.1 Furnaces up to 3.6 kW – B 130, B 150, B 180, C 280, C 290, C 295, P 330

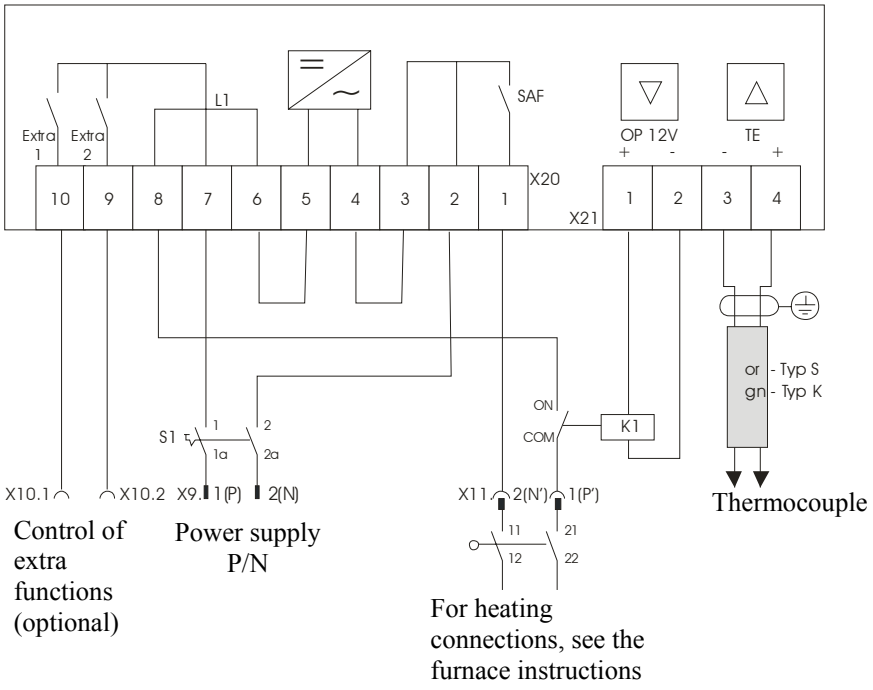



Fig. 26: Furnaces up to 3.6 kW

## 17.2 Furnaces > 3.6 kW with Semiconductor Relay - B130, B150, C280, C290

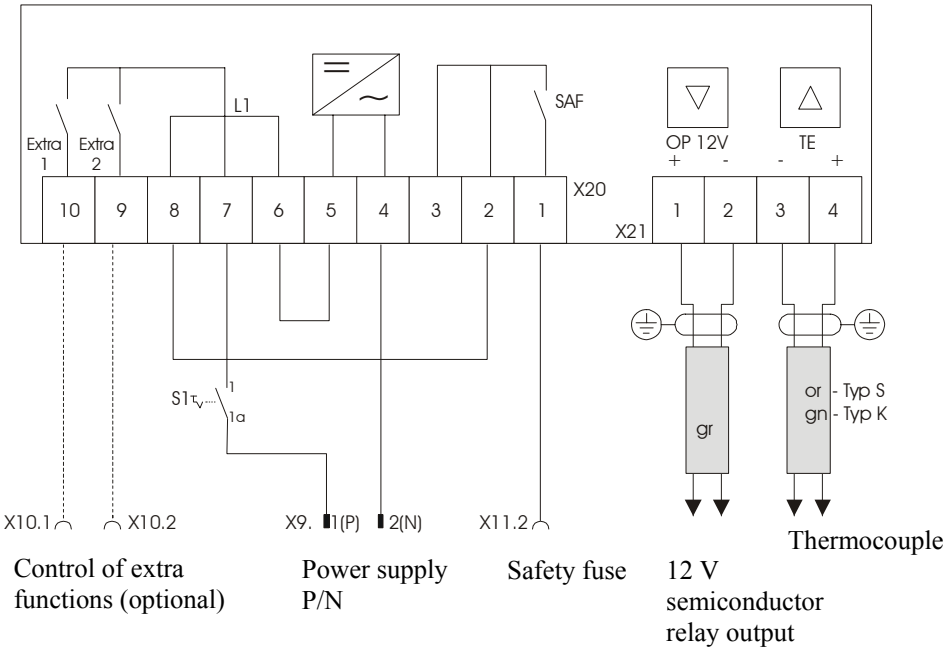



Fig. 27: Furnaces > 3.6 kW with semiconductor relays

## 17.3 Furnaces > 3.6 kW with Heat Fuse – B 130, B 150, C 280, C 290

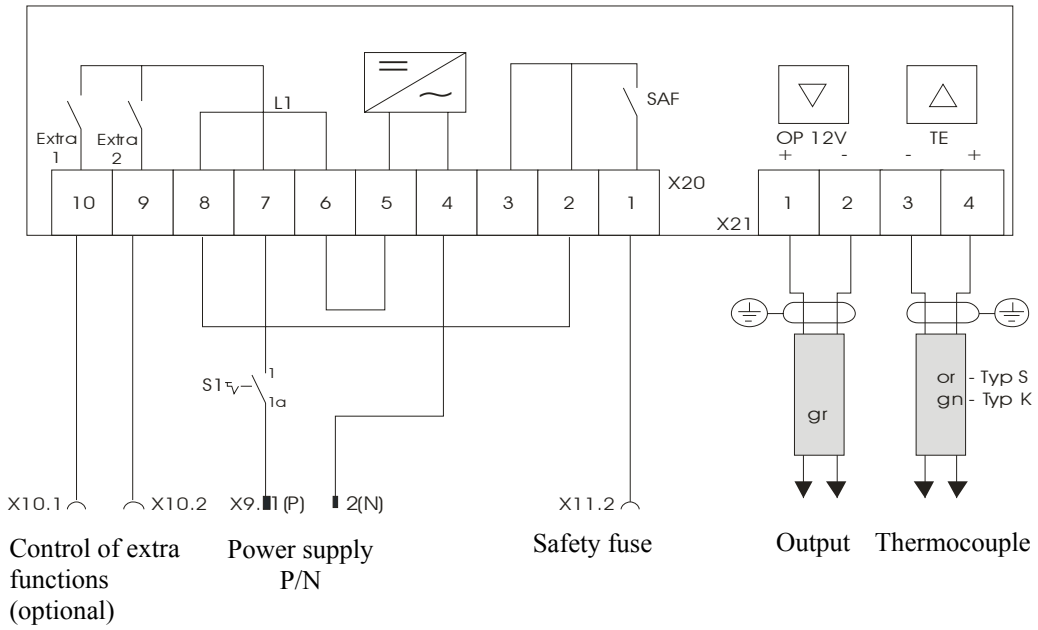



Fig. 28: Furnaces > 3.6 kW with heat fuse

## 17.4 Furnaces > 3.6 kW with 2 Heating Circuits – C 295

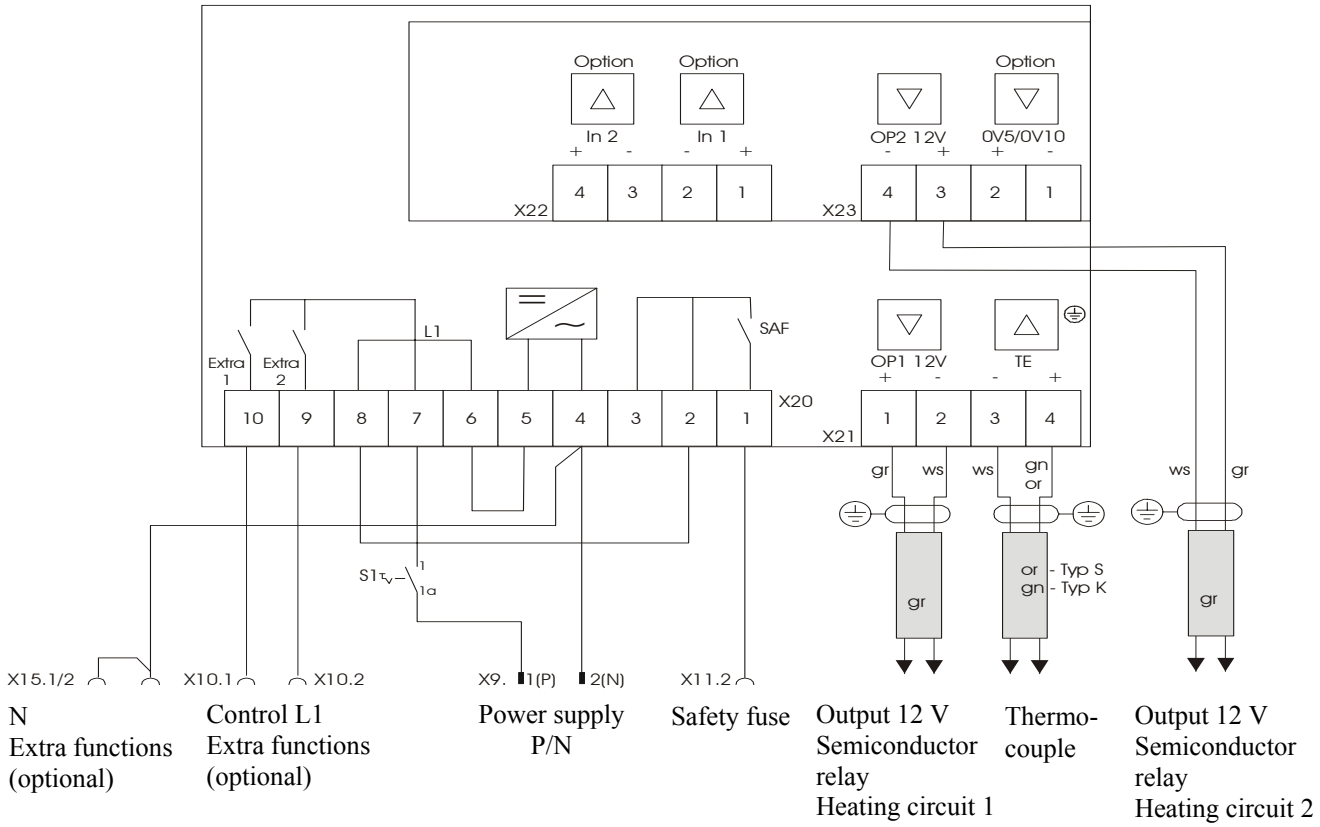



Fig. 29: Furnaces > 3.6 kW with two heating circuits – C 295

## 17.5 Replacement Controller for Models C/S 3; C/S 5; C/S 7; C/S 8; C/S 19; C/S 30

### 17.5.1 Replacement for old S Controller up to 3.6 kW

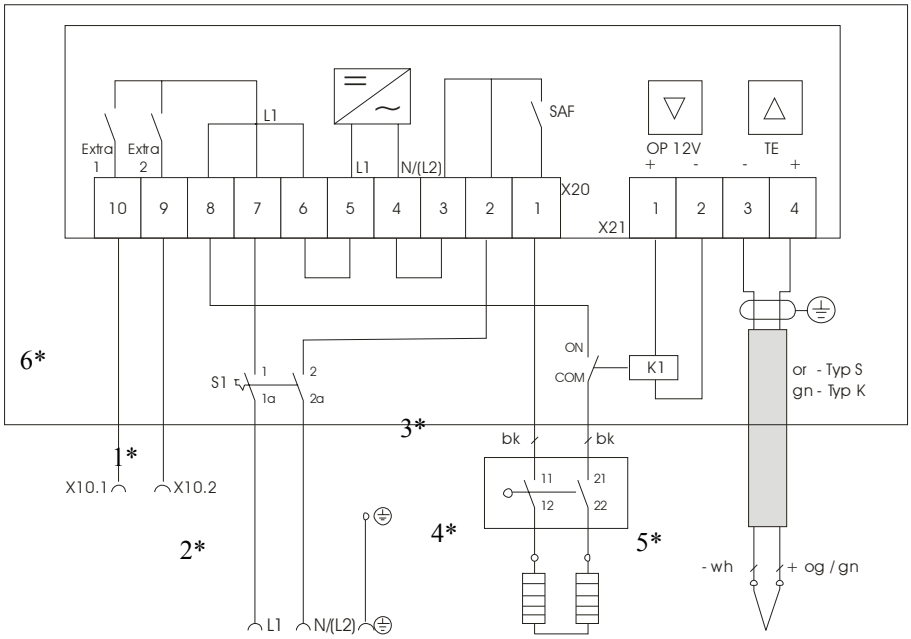
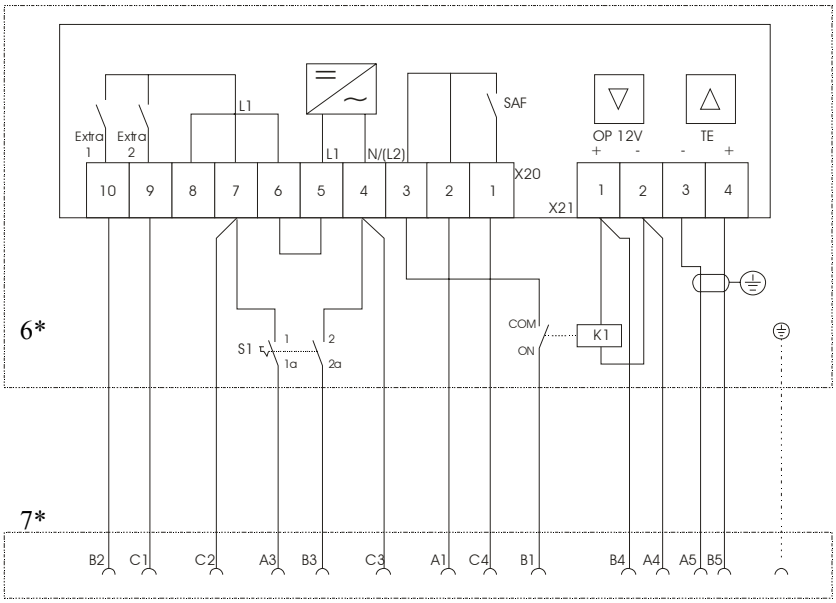



Fig. 30: Replacement for old S controller up to 3.6 kW

### 17.5.2 Replacement for old C Controller




Legend:

1* = Control of
extra functions (optional)
2* = Power plug
3* = Door contact switch
4* = Furnace heating
5* = Thermocouple
6* = Controller
7* = HAN 15D plug connector
bk = black
og/gn = orange/green
wh = white

Fig. 31: Replacement for old C controller

# 18 Nabertherm Service

For the maintenance and repair of the system, the Nabertherm Service department is available at any time.

If you have questions, problems, or desires, please contact Nabertherm GmbH. In writing, by telephone, or through the Internet.

**In writing**

Nabertherm GmbH

Bahnhofstrasse 20

28865 Lilienthal/Germany

**By telephone or fax**

Phone: +49 (4298) 922-0

Fax: +49 (4298) 922-129

**Internet or email**

www.nabertherm.com

contact@nabertherm.com

**When making contact, please have the type plate data of the furnace or controller ready.**

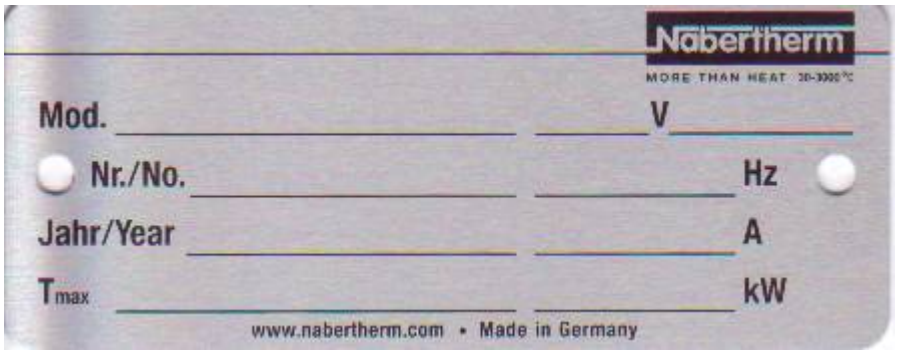



Fig. 32: Type plate

## 19 For Your Notes